

# ROADS AND STREETS

*Design, Construction, Maintenance and Traffic Control*  
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## \*See the Road and Street Catalog & Data Book

In addition to the advertising messages to be found in this issue of Roads and Streets on the pages as indicated above, condensed catalogs of those marked \* as well as other specifications and construction data will be found in the Road and Street Catalog and Data Book, the 384 page annual reference guide for the highway industries, published by the Gillette Publishing Co.



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# ROADS AND STREETS

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Vol. LXXI

Chicago, September, 1931

No. 9



Unloading Tarvia-lithic with Clam Shell Bucket

## PRE-MIXED TAR MACADAM *Pavement Constructed of Manufactured Materials*

By GEO. E. MARTIN

*Consulting Engineer, Tarvia Department, The Barrett Company*

IT is the aim of all modern industrial organizations to discover and develop new materials and methods to meet the constantly changing conditions. The producers of highway materials have had this problem continually before them since traffic has been steadily increasing in intensity, and apparently will continue to do so for some time.

Knowing that the English tar macadam had given satisfactory service under heavy traffic for twenty years or more, it was decided to make a careful investigation of the English practice and the results obtained. This was done in the spring of 1926. The survey established the fact that the basic idea of the English tar macadam, namely an open mix depending for its stability upon the interlocking of the stone fragments was sound. However due to differences in climate, traffic, working conditions, etc., it was considered inadvisable to transport the English tar macadam bodily to the United States. England has a damp climate with comparatively little change in temperature. Some modifications would be necessary to take care of the widely varying temperature conditions in the United States. The English en-

gineer expects to use a considerable labor and does not demand the construction speed required in the United States. Modifications to permit machine unloading and machine handling would be needed. Immediate surface treatment of the completed pavement was standard English practice, but considered unnecessary here.

An experimental plant for testing tar bound roads was assembled in 1926 and trial batches made up, shipped and used where they were subjected to heavy traffic.

In this experimental plant the stone was dried in a sand drier. As a result of the high heat necessary to dry the stone, part of the limestone was calcined and thus weakened. Later plants were designed to subject the stone to a fairly low heat for a comparatively long time. A grade of tar approximating that used in England was used and variations in the consistency were also tried.

The experimental material was loaded into gondola cars and shipped about two hundred miles. There it was unloaded by hand and used to resurface an old macadam street having very heavy traffic. This street



was under observation during 1926 and 1927. While the material had been somewhat difficult to unload, and some trouble was experienced in rolling, the final results were sufficiently encouraging that it was decided to build a commercial plant in 1927.

As a result of the preliminary experimental work, certain requirements were set up as essential to the production of a satisfactory tar mix. They are as follows:

*Coarse Aggregate.*—The coarse aggregate must be clean and uniform in quality and size. This seems obvious but it is not always easy to get closely screened aggregate of uniform quality throughout the working season. In the later mixing plants, vibrating screens have been included so that quarry variations in stone sizes could be corrected.

*Fine Aggregate.*—The same requirements as for coarse aggregate.

*Aggregate Sizes.*—Sizes of material produced at the various plants has been influenced by the sizes produced by the quarry and by the specifications under which the



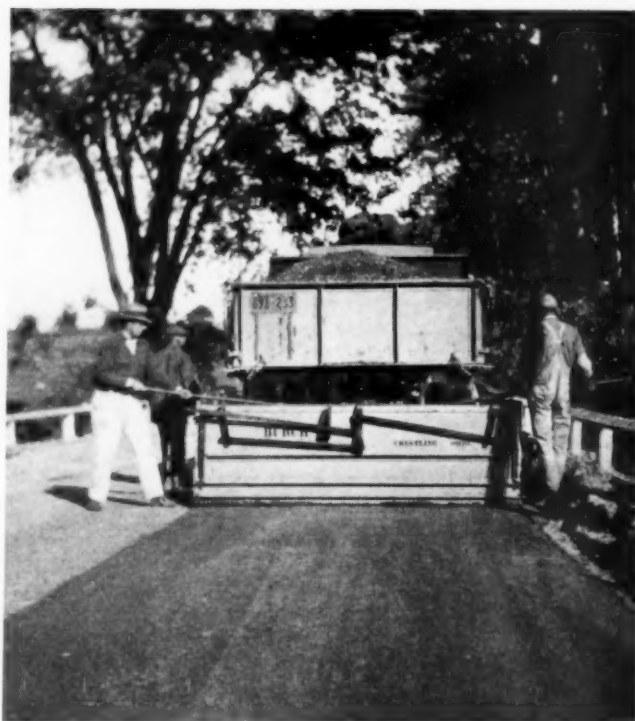
*Typical Tarvia-lithic Manufacturing Plant*



*Tarvia-lithic Surface on Parkway in Bay City, Michigan*

material must be sold. In general the material is produced in three sizes, the coarse mix ranging in size from  $1\frac{1}{4}$  in. to  $2\frac{1}{2}$  in.; the intermediate mix ranging in size from  $\frac{1}{2}$  in. to  $1\frac{1}{4}$  in.; and the fine mix from  $\frac{1}{8}$  in. to  $\frac{1}{2}$  in.

*Cleaning and drying aggregate.*—When it enters the mixer the aggregate must be clean and dry and at the proper temperature, which is about 100 deg. F. The aggregate is dried by screening it through a cylindrical drier where it is subjected to the action of hot gases forced through the aggregate by a fan. The dust is thus removed at the same time and collected for use in the fine mix. Accurate control of the aggregate temperature is very necessary since too hot stone will distill



*Spreading Material with Stone Spreader*

the thin tar coating producing an unsatisfactory binder.

*Tar.*—A tar binder has been developed which produces a mixture which can be easily unloaded from the cars and handled on the road and yet when subjected to rolling will bond together into a solid mass. This has been accomplished by selecting particular crude tars for



*Close-up View of Surface Showing Non-Skid Character*



the base and refining them to the proper consistency for the season when the mix is to be used. The tar must also be at the proper temperature for mixing, which will be from 160 deg. to 200 deg. F. depending upon the temperature of the stone.

**Proportions.**—The proper proportions of tar and aggregate for the coarse and intermediate mix will depend upon the grading of the aggregate. As much tar as the stone will hold should be used but too much will result in tar running from the stone to the bottom of the cars. The amount of tar will vary from three to five per cent but the exact amount must be worked out, by trial, for each individual stone supply. In order to insure the exact amount of tar specified, the tar scales in the plants have been equipped with an electrical cut off which prevents an over-supply of tar in any batch. The aggregate is weighed by the mixer operator. The proper proportions for the fine mix has been the subject of considerable study and experiment. Trial sections using various proportions of tar, fine aggregate, stone dust and sand were laid near the first plant and closely observed. From this experience it was determined that both sand and dust filler should be used in the fine mix. The exact proportions vary with the different stone supplies.

and can be readily unloaded by mechanical unloading equipment or by manual labor. It is handled cold on the job and is unique in that it can be stored in stock piles and used as needed. The material sets up on the outside but there is very little change in the interior.

Owing to the qualities of the tar binder the tar concrete does not set up in the cars even though they may be in transit for some time. There is a setting up action in the first twenty-four hours but apparently little change after that time. The sides and floors of the cars are well wet down before loading and this prevents material from sticking to the cars.

Four men with forks can unload a forty ton car of Tarvia-lithic in a day. The unloading cost by this method will run about fifty cents per ton.

The unloading can be done more quickly and economically with a clam shell bucket. This apparatus will ordinarily unload material from the car as rapidly as it can be placed on the road.

Experience has shown that this mix can be handled through bottom dump battleship cars. The car is placed on an elevated trestle and the tar concrete dumped directly into the truck. This is the easiest and cheapest method of unloading.

### Rock Quantities for Various Thicknesses of Tarvia-Lithic Pavement

Aggregate	Finished Thickness in In.	BOTTOM COURSE				TOP COURSE				Total Loose Depth in In.
		Wt. Lb. per Sq. Yd.	Sq. Yd. per Ton	Size of Mix	Loose Depth in Inches	Wt. Lb. per Sq. Yd.	Sq. Yd. per Ton	Size of Mix	Loose Depth in Inches	
Trap or Granite	1	114	17.5	-----	-----	-----	-----	Fine	1½	1½
	2	230	8.7	Interm	2¼	154	13.0	Fine	1	3¼
	2½	247	8.1	Interm	2½	171	11.7	Fine	1	3½
	2½	266	7.5	Coarse	2¾	190	10.5	Fine	1	3¾
	2¾	301	6.6	Coarse	3¼	225	8.9	Fine	1	4¼
	3	318	6.3	Coarse	3½	242	8.3	Fine	1	4½
Limestone	1	108	18.5	-----	-----	-----	-----	Fine	1½	1½
	2	223	9.0	Interm	2¼	151	13.2	Fine	1	3¼
	2½	240	8.3	Interm	2½	168	11.9	Fine	1	3½
	2½	258	7.8	Coarse	2¾	186	10.8	Fine	1	3¾
	2¾	292	6.9	Coarse	3¼	220	9.1	Fine	1	4¼
	3	309	6.5	Coarse	3½	237	8.4	Fine	1	4½



Finished Job on Forest Ave. at Rye, N. Y.



Complete New York State Highway Surface Near Cato, New York

The amount of tar also varies but is usually from 7 to 9 per cent. A typical grading is as follows:

Fine aggregate .....	77 per cent
Sand .....	5 per cent
Dryer Dust .....	10 per cent
Tar .....	8 per cent

Careful attention to these essentials will produce a mix which can be used without heating. The major portion of the production has been shipped in railway cars, although in some instances it has been hauled direct to the job from the mixing plant.

The tar coated stone is shipped in open topped cars

This tar concrete may be used as a wearing surface over any foundation solid enough to support the weight of the traffic coming upon it. In practice it has been placed on new foundations of macadam and cement concrete and over old brick, asphaltic concrete, penetration macadam, waterbound macadam and cement concrete.

The tar coated stone is manufactured in three grades as previously described.

As built, the pavement consists of a bottom or binder course of the coarse or intermediate mix and a top or wearing course of the fine mix. It is essentially an open mix type and depends, for its stability, on the inter-

locking or keying of the stone fragments by rolling. The bottom course is from one and one-half to three inches thick, after rolling. The accompanying table gives the quantities required for various thicknesses.

Both the fine and the coarse or intermediate mix can be spread on the job through an open box stone spreader. By this means the amount of labor required is reduced to a minimum. There is also a further advantage that the material is uniformly spread and an easy riding surface is produced.

Excellent work has been done spreading the material, by hand, with forks, from dumping boards. In some cases it has been taken from the trucks with forks and placed on the road surface.

Three wheeled macadam rollers are generally used to consolidate each course. They should produce a compression of at least 300 pounds per inch of width of wheel, which means that about a ten-ton roller is needed. Twelve-ton tandem rollers have also been used. Since the roller operates directly on the tarred stone it is necessary to wet the wheels to prevent picking up. A mixture of water and not more than ten per cent of lubricating oil may also be used. This same mixture may be used on the inside of trucks and on the handling of tools to prevent sticking.

After considerable experimental work a fine mix has been developed which does not require a liquid seal. This is accomplished by introducing the proper amount of filler and by the use of specially prepared high carbon tar.

The construction operations involved in building a pavement of this sort are extremely few and simple. After the foundation is prepared, spread the coarse mix, roll, spread the fine mix, roll, and open at once to traffic.

This type of pavement construction comes close to being a machine operation in spite of the fact that no extensive machinery outside of the central mixing plant is required. Absolute control of all of the stages in the manufacture of the material is assured and a uniform product is available at all times. Remarkable ease in handling has been achieved by the development of correct tar binders, proper grading and handling of the aggregate and careful combination of them into the final mixtures.

Engineers and highway officials were some skeptical of this construction at first because of the open character of the mix and the granular appearance of the top. However the advantages of the granular top in producing a skid-proof surface and the structural stability of the open mix have been proved in service.

### Washington Area Traffic Survey Plans Progressing

Organization of the traffic survey of the metropolitan area of Washington is progressing rapidly, according to Thomas H. MacDonald, Chief of the Bureau of Public Roads of the U. S. Department of Agriculture. The survey begins early in September and the movements of many thousands of motor vehicles will be charted and analyzed to serve as a basis for a program of highway improvement for the area.

The survey is to last a full year, during which the daily movement of vehicles on the main traffic arteries in the region immediately surrounding Washington will be recorded. The information thus accumulated will be used in outlining a comprehensive plan of highway bet-

terment in this area, in which the States of Virginia and Maryland and the counties immediately adjacent to Washington will participate.

With their schedules in hand, the recorders will place themselves at the point designated when the survey begins. They will be equipped with the flags and signs to inform vehicle drivers of the work in progress, and with report blanks, counting devices, etc. They will record numbers of passenger cars, trucks and busses passing each station, the State in which vehicles are registered as indicated by the license tags, the direction of travel and observations as to weather conditions.

An additional duty of the recorders, and an important one, will be the handling of franked mailing cards, known as "origin-destination" cards, to as many drivers as possible. These cards, calling for such information as mileage traveled during the day, exact place of origin and destination of the trip and number of passengers, are to be filled in by drivers and mailed free to the Bureau of Public Roads at Washington. This information is regarded as of primary importance, and those in charge of the work are making an especial appeal to drivers for cooperation in accepting and returning these cards.

The daily reports of the traffic recorders and the "origin-destination" cards received through the mails will be tabulated by the Bureau of Public Roads. Statistics will be compiled and maps will be drawn showing the average daily volume of traffic on all important routes and providing definite facts for working out the character and priority of highway improvement.

This survey will be the most extensive of the kind ever conducted in the vicinity of the National capital. Cooperating with the Bureau of Public Roads in the work will be the following agencies: The National Capital Park and Planning Commission; the District of Columbia; the State Roads Commission of Maryland; the State Highway Commission of Virginia; the Maryland National Capital Park and Planning Commission; the City of Alexandria; the counties of Arlington and Fairfax, Virginia; and the counties of Prince Georges and Montgomery, Maryland.

### Southwest Road Show and School

The seventh annual Southwest Road Show and School, will be held Feb. 23, 24, 25 and 26, at Wichita, Kans.

Nine states surrounding the road show and school had exhibits at the 1931 event; also the United States Bureau of Public Roads; American Association of State Highway Officials; Republic of Mexico, colleges and universities. Indications at this time point to a repetition of this for the 1932 School augmented by exhibits from other states, colleges and universities. Valuable lectures and able discussions of road construction and maintenance will be delivered.

Bigger and more elaborate plans than ever are now in progress for the coming show and school which it is believed will make the 1932 event eclipse in magnitude and interest any and all former affairs of this kind. Present indications point to more comprehensive exhibits of improved road machinery, accessories and materials, also a wider variety than has been shown heretofore.

The management reports that many exhibit reservations have been recorded and more than ordinary interest shown over the territory.

# Industrial Management Methods as Applied to Highway Work

*What professional industrial engineers can do to assist in working out these problems*

By W. M. LECLEAR

Partner in Scovell, Wellington & Company, Chicago

CONSTRUCTION and maintenance of state highways has reached a point where it is one of the real big businesses of this country and is exceeded by few industries. When we consider that the enormous amount of \$1,000,000,000 has been appropriated for the year 1931 for state highway departments alone, to say nothing about appropriations by counties, townships and cities, the magnitude of the problem is easily appreciated. As a matter of fact in most states highway construction and maintenance at present constitutes by far the largest governmental activity from the standpoint of expenditure and personnel.

Obviously any organization expending many millions of dollars annually and involving large communities for many years to come in taxation and bond indebtedness should be governed by the very best business methods. Some of the state highway departments, notwithstanding the fact that they have only been organized for a very few years, have made rapid strides in this respect; others, however, have not as yet in many respects recognized the necessity of the application of the same sort of principles as would apply to a well organized industrial concern.

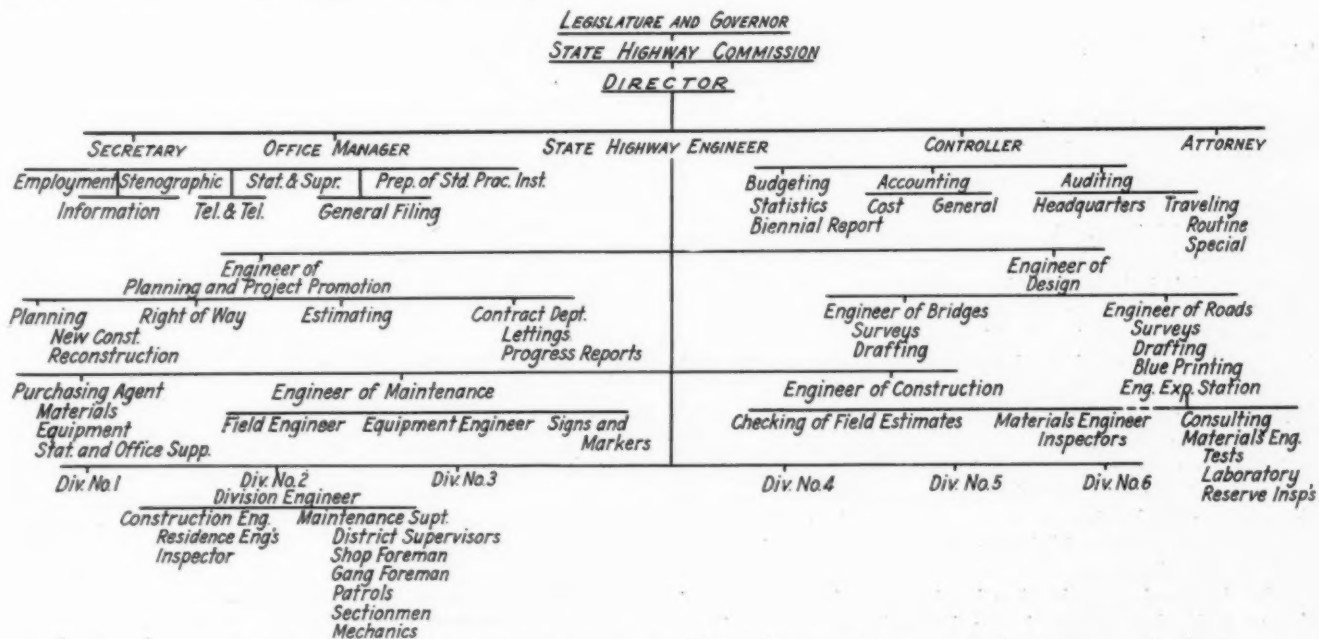
The press and the people of today are talking more and more about the use of business methods in public offices; and considering the number of people employed in this work and the tremendous amount expended annually at public cost, it is not surprising that the public should not only insist that its money be hon-

estly spent but that it also be wisely spent. It therefore behooves highway officials, if for no other than selfish political reasons, to recognize this public demand and insist that their departments adopt and follow the best available business methods in the conduct of their activities.

During the past fifteen years a profession known as "industrial engineering" has come into prominence and general use and respect. The men engaged in this profession, as a result of their education, training and experience, are prepared to make a scientific analysis of the various administrative, engineering and accounting problems of any business and can be of great service in assisting to place a highway department on the same scale of efficiency as any industrial concern, and their services along these lines have been recently used with excellent results in several states.

By reason of his disinterested and impartial attitude, the industrial engineer can report on conditions as he finds them and is uninfluenced by those personal and political feelings which would inevitably influence a survey report made by an employee of the highway department itself, however competent such individual might be. Competent industrial engineers of national reputation should therefore generally be employed to make surveys of the various activities of a highway department.

In a general way such a survey consists of a study of:



Organization Chart Recommended to Highway Commission of a Southwestern State



1. Present Organization
  - (a) How organized—Chart of Personnel and Duties
  - (b) Intelligence and Fitness of Personnel
2. Laws Pertaining to Highway Department for Purpose of Determining if They Are Being Complied With
3. Accomplishments
  - (a) Past Record
  - (b) Present Status
  - (c) Future Plans

A careful investigation of these factors will disclose the weakness or the strength of the administrative, engineering and accounting departments and will more specifically disclose, among others, such matters as:

1. Is the department administered according to the law and should the law be amended so as to enable the administrative department to operate more efficiently?
2. Are the expenditures, including administrative, construction and maintenance, subjected to budgetary control?
3. Are standard costs determined for various construction jobs and maintenance operations?
4. Is there proper control of maintenance and construction costs by the accounting department?
5. Have wages been standardized as far as possible?
6. Is the administration and supervision of the payroll carried out in a manner that will eliminate the possibility of carelessness and fraud?
7. Is the accounting department properly centralized or is too much work required to be done at division offices, with resultant delay and increased expense?
8. Are disbursements made in such a manner as will assure the obtaining of all discounts possible?
9. Are the accounts set up in such a manner as will permit of the published reports being intelligently compared with those submitted by other state highway departments and to agree with the information published by the state treasurer or other state officers?
10. Is construction work properly planned and is it planned sufficiently in advance so as to permit of right-of-way acquirement to the best advantage and so as to obtain Federal Aid when available?
11. Are the division offices relieved of all unnecessary details so that the division officers may devote the greatest amount of time possible to road construction and maintenance work?
12. Has the department devised a well formulated plan for highways, having regard both to political expediency and the welfare of the entire state?
13. Is the purchasing department functioning properly and what are the possibilities of duplicate payments, purchase of material at prices above the market, etc.?
14. Is the highway department credited with all the vehicle license fees, gasoline tax, and other monies to which it is entitled?
15. Are the finances in regard to "Benefit District" roads properly handled?
16. Is the work of various departments so planned as to eliminate duplication of work?
17. Are inventories of materials and equipment properly controlled?

It is very apparent that if such matters as those enumerated, as well as similar matters, are placed on the proper basis that a tremendous saving will result as compared with a highway department that is operated on a "hit or miss" plan.

The form of organization is also very important and the organization chart shown herewith may be of interest. This chart was devised by us in connection with

a survey recently made for one of the great wheat raising states.

This sort of work is part of the every day life of the industrial engineer. The recommendations contained in his survey could in most instances be put into effect by department employees, but it is generally advisable that he supervise the installation of such changes which his preliminary survey report has convinced the highway commissioners to be desirable, as by this means personal friction is reduced to a minimum and the installation of a comprehensive plan guaranteed.

### Cost of Painting Center Line in Minnesota

In Minnesota, a center line is painted on all pavements as a guide to traffic. The painting is done by one truck and crew. The truck carries the paint and also applies it by means of an auxiliary wheel that squeezes the paint onto the slab as the truck runs along the pavement.

During 1928 and 1929 the cost of such center line marking was as follows:

#### CENTER LINE MARKING—MINNESOTA HIGHWAY DEPARTMENT

1928		
Expenditures:		
2,290 gal. black paint.....	\$1,038.24	
602 gal. yellow paint.....	1,245.22	
648 hours labor application.....	498.68	
Expense accounts .....	110.67	
Expense of marker truck.....	1,050.00	
		\$3,942.81
Work Performed:		
Miles marked:		
Black .....	404.5	
Yellow .....	89.2	
		493.7
Average Cost per Mile Marked:		
	Black	Yellow
Paint .....	\$2.567	\$13.960
Labor .....	1.233	1.230
Equipment .....	2.127	2.127
Totals .....	\$5.929	\$17.317
1929		
Expenditures:		
2,660 gal. Tarmac .....	\$484.78	
264½ gal. yellow paint.....	544.34	
200 gal. yellow paint.....	238.92	
1,147 labor of application.....	998.56	
Exp. accts. drivers.....	251.55	
Marker truck (garage, oil, grease, repairs, depreciation) .....	1,150.50	
		\$3,668.15
Work Performed:		
Miles marked:		
Black .....	426.7	
Yellow .....	109.9	
		536.6
Average Cost per Mile Marked:		
	Black (Tarmac)	
	Cost per Mile	
Paint .....	1.136	
Labor and expense accounts.....	2.329	
Equipment .....	2.143	
	\$ 5.608	
	Yellow	
	Cost per Mile	
Paint .....	7.127	
Labor, etc. ....	2.329	
Equipment .....	2.143	
	\$11.599	

# High Production Results from Efficient Management

**A**N unusual rate of production in asphaltic concrete paving work was maintained on Federal-Aid Project No. 194-A, California, during the construction season of 1930. This project is situated south of Fresno, Calif., between Malaga and Fowler and extends south of the latter place. In the period, Aug. 18 to Oct. 8, a total of 43,556 tons of asphaltic concrete was laid over a distance of 7.54 miles, giving an average production for each 8-hour operating day of 1,050 tons. The maximum for any one day was 1,204 tons. The contractor who did this work carried his production efficiency to increasing high standards during 1930. On two previous jobs, at Salinas, Calif., and at Tulare, Calif., average production rates of 802 tons and 927 tons, respectively, were established. An interesting account of the work on Project No. 194-A was given by R. W. Edwards and N. L. James, Junior Highway Engineers, U. S. Bureau of Public Roads, in *Public Roads*, the official publication of the Bureau, from which the matter following is taken.

That the high rate of production was largely due to efficient management is demonstrated by the results of production studies conducted on this project by the United States Bureau of Public Roads. A scientifically designed asphalt plant of large capacity was selected for the work, together with auxiliary equipment capable of keeping pace with it. Labor and directing personnel were efficient and well paid. Studies of time and production losses on previous jobs enabled the contractor to eliminate such losses on this project. The production studies show that the total loss of available operating time was less than 10 per cent, while the time lost with the crew on the job was less than 3 per cent.

**Three-Course Pavement Constructed.**—The entire 7.54 miles of asphaltic concrete surface were laid on an old Portland cement pavement, with the exception of a few changes of alignment which required construction over a new subgrade. For a distance of 4.69 miles, between Malaga and Fowler, the asphaltic concrete was laid to a width of 30 ft. The remaining 2.85 miles, lying south of Fowler, is 20 ft. wide. The new pavement was constructed in three courses, a base or primary leveling course, used to fill in shoulders, etc., a leveling course, and a surface course. The latter is normally 2 in. thick, while the thickness of the other courses varies considerably. The total thickness of the pavement varies from 9 in. at the edges to about 3 in. at the center, depending upon the irregularities of the old pavement.

**Working Days, Progress and Prices.**—The contract was awarded on July 16, 1930, and the work of clearing and grubbing and providing material for grading the road-bed for the new construction was begun on July 17. Work on culverts and small structures was begun on July 21. Erection of the asphalt plant was begun at Malaga on July 16. The plant erection was completed on August 15, and other preliminary work was sufficiently advanced or completed to permit asphalt paving to start on Monday, August 18. The paving was in progress from August 18 to noon of Oct. 8, a total period of 51½ calendar days, including 7 Sundays, Labor Day, and one Mexican holiday. This resulted in

42½ available working days, and out of this one day was lost due to rain or wet grade. The daily average was 1,049.5 tons per actual working day and 1,023.4 tons per available day.

The price received for the asphaltic concrete was \$4.01 per ton. This price covered all items from furnishing and setting permanent wooden forms to finishing and rolling the pavement. The total for 43,556 tons was approximately \$174,660, or \$23,164 per mile. The cost per square yard was approximately \$1.50.

**The Contractor's Organization.**—The general superintendent for the paving company had complete charge of the entire contract and the superintendent of plants was in charge of plant operations. There was a capable foreman for each division of the work, such as hauling, spreading and finishing, setting forms, etc. Two experienced timekeepers were employed to take care of the clerical work and to attend to the ordering of all materials and supplies. These timekeepers enabled the superintendent to devote his entire time to planning and supervision. A carefully planned and detailed schedule of operations was prepared at the start of the job and as a result no delays whatever occurred due to lack of planning or to inefficient management. It was the duty of each foreman to see that his equipment and personnel functioned efficiently and to correct delays immediately. It was through this specialization on the part of the men and coordination on the part of the general superintendent that this job proceeded so smoothly and at such a remarkable rate.

The normal crew per working shift averaged 62 men, which included 16 at the plant, 8 hauling materials to the job, 17 handling material on the job, including rolling, etc., 12 form setters and 9 on supervision and miscellaneous work.

**The Equipment Used.**—The major items of equipment were:

- 1 new, all-steel, portable asphalt plant, consisting of a 4,000-lb. 80 r.p.m. pug-mill and a 6-ft. by 22-ft. 8 r.p.m. dryer.
- 1 1¼ cu. yd. clamshell crane (feeding plant).
- 10 trucks hauling 3 batches or 6.3 tons.
- 3 9-ft. spreader boxes.
- 1 30-ft. finishing machine.
- 1 20-ft. finishing machine.
- 1 10-ton, 3-wheeled gas roller.
- 3 8-ton tandem rollers.
- 1 water-tank truck.
- 4 runabout passenger cars.
- 1 blacksmith shop.
- 1 portable field office.

All of the above equipment was of the latest design and in first-class condition.

**How Materials Were Handled.**—Materials other than sand were delivered by rail to the plant, located on a siding at Malaga, near the north end of the project. Sand was produced locally and hauled to the plant by sub-contract from pits about 8 miles distant. One pit supplied coarse sand and the other fine sand. It was necessary to premix or blend these sands at the plant to obtain the grading required in the specifications.

The aggregates were unloaded from cars by the 1¼-yd. clamshell crane and either stock-piled or fed



into the hoppers at the cold elevator. There were three of these hoppers. One was used for the sand and No. 4 rock, the latter varying from  $1\frac{1}{4}$  to  $\frac{3}{4}$  in. in size. A second hopper was used for No. 3 rock, varying from  $\frac{3}{4}$ -in. to rock retained on a No. 3 screen, and a third for No. 2 rock, which was such as to pass a No. 3 screen and be retained on a No. 10 screen. The sand used was such as to pass a No. 10 screen and included some finer than that retained on a No. 200 screen. Three adjustable gates, regulated by a feeder operator, admitted each size of material to the boot or hopper of the cold elevator. It is interesting to note that each of these materials arrived at the plant in precisely the grading desired in the four hot-storage bins. This was the chief reason for the exceptionally small percentage of bin delays or delays due to lack of proper size of hot aggregate.

**The Mixing Plant.**—Materials after leaving the stock piles passed through the dryer where they were heated to 375 deg. or 400 deg. They were then conveyed by a bucket elevator to the screens where they were screened and chuted into four hot-storage bins, each bin containing a certain size. All aggregates passed the  $1\frac{1}{4}$ -in. screen except part of that for the base course, where a maximum size of 2 in. was used.

Passing from the hot-storage bins, materials were batched by weight in the weigh box, which was suspended on multiple-beam scales, so that each size could be weighed rapidly and accurately. Dust was conveyed from a dust hopper to the weigh box by means of a mechanically driven screw operated by the batcher operator, and weighed on the multiple-beam scales. The dust was not heated. After the materials were weighed, they were dumped into the mixer box by the mixer operator. The gate of the weigh box opened at right angles to the mixer shafts; this arrangement facilitated even distribution of the materials in the mixer. Baffle plates were installed in the weigh box to distribute the materials issuing from the four hot-storage boxes. In order still further to assure even distribution, a definite sequence was adopted for weighing each material.

Asphalt cement, heated to about 280 deg. was weighed and admitted to the mixer, parallel to the mixer shafts, by another operator, who also discharged the mixer and dumped the truck hopper or "gob" box. The mixer gate and truck hopper were operated by steam pistons, controlled by steam valves.

**Hauling Operation.**—The asphaltic concrete, after being weighed by the state highway authorities, was hauled to the job in trucks equipped with tarpaulins. All trucks hauled three batches or 6.3 tons, and all trucks were pneumatic tired. Truck speeds averaged 22 miles per hour. The trucks were turned about 200 ft. ahead of the finishing machine and were backed and hooked to the spreader boxes. The contents of each were then dumped on the street ahead of the finishing machine to approximately the desired depth. The terminal time constants of operation for these trucks averaged 6.5 minutes per trip. A careful scrutiny of the time of arrival and departure of trucks from the plant was made by the company to check upon the efficiency of truck operation.

**Finishing Machines.**—A finishing machine was employed to spread the material and strike it off to the desired section. For the 30-ft. section a rebuilt machine was used. For the 20-ft. section a regular finishing machine, partly rebuilt and speeded up, was used. Studies disclosed that the 30-ft. machine would travel at the rate of 7.8 ft. per minute and would handle approximately 194 tons per hour, while the 20-ft. machine would travel 12.6 ft. per minute and handle 205 tons per hour.

Compaction was obtained by the use of four rollers, one 10-ton, 3-wheel roller and three 8-ton tandems. The 10-ton and one 8-ton roller were used for longitudinal rolling and the other two 8-ton rollers were used for transverse or crescent rolling. Late in the afternoon two of the 8-ton tandem rollers were used to roll out bumps.

**Production Studies.**—The studies conducted on this project by the engineers of the Bureau of Public Roads covered the period from Sept. 15 to Oct. 8, and included the following major items:

1. Making several stop-watch studies every day of the operation of the asphalt plant. The purpose of these studies was to determine the amounts and sources of delays at the mixer.

2. Making daily stop-watch studies of auxiliary equipment to determine their rates of production and to ascertain whether or not they favored or limited the attainment of maximum production by the asphalt plant.

A number of other features of the construction were also studied, including mixing time tests to determine the effect of the length of mixing time on the distribution of aggregates and asphalt in the mixer.

In order that the mixing operation might be carefully controlled during the period when time studies were being made, a timing device was installed on Sept. 3. Although it was an innovation in asphalt work, the use of this device resulted in an almost clock-like regularity of plant operation, a nearly constant mixing time, and approximately a 6.5 per cent increase in rate of production.

For the purpose of the production study, the charging time was taken as the total time consumed in emptying all ingredients into the pugmill. The mixing time was taken as the interval between the completion of the charging and the opening of the discharge gate. The discharge time was taken as the time from the opening of the gate to the completion of discharge. A summary of the results of the plant production study is given in Table I. It will be observed that for the base and leveling courses the possible number of batches per hour proved to be 73, while for the surface course 61.2 batches were found to be possible. Minor delays brought these rates down to 69.8 and 60.6 actual batches per hour, respectively. These figures are practically the same as the maximum production rates allowed by the state authorities, who would suspend plant operation if production exceeded 70 batches per hour for the base and leveling courses and 60 batches per hour for the surface course. The reason for the dif-

TABLE I—PRODUCTION DATA FOR PERIOD OF STUDY, SEPTEMBER 15 TO OCTOBER 8, 1930

Item	Base and leveling courses	Surface course and screenings
Charging time, seconds.....	6.8	15.7
Mixing time, seconds.....	28.3	27.9
Discharge time, seconds.....	14.2	15.2
Total cycle, seconds.....	49.3	58.8
Net batches possible per hour.....	73.0	61.2
Per cent of hour lost in minor delays....	4.45	0.78
Per cent of hour utilized.....	95.55	99.22
Actual batches per hour.....	69.8	60.6
Actual tons per hour of operation.....	152.0	131.0
Average tons per day on days operated	1,066.9 <sup>1</sup>	
Average haul to job, miles.....	5.57	
Average number trucks for both courses .....	15.2	
Actual job efficiency including unavoidable delays .....	90.41	
Actual job efficiency excluding unavoidable delays .....	97.14	

<sup>1</sup>All courses.



**TABLE II—PRODUCTION DATA FOR ENTIRE PAVING PERIOD, AUGUST 18 TO OCTOBER 8, 1930**

Item	Base and leveling courses	Surface course and screenings	Entire job
Total hours mixing time .....	208.80	108.25	317.05
Total tons mixed.....	29,823.05	13,732.91	43,555.96
Total batches mixed.....	13,548	6,373	19,921
Average tons per batch.....	2.20	2.15	2.19
Actual batches per hour.....	64.89	58.87	62.86
Actual tons per hour.....	142.83	126.85	137.38
Average tons per day on days available .....			1,024.85
Average tons per day on actual working days .....			1,049.50

ference between the number of batches allowed for base or leveling course and surface course was the fact that the state required a "double charge" on the surface materials, i. e., No. 3 stone was weighed separately and after the weighing and dumping of the other aggregates.

The production data for the entire paving period are given in Table II. It will be noted that the actual number of batches per hour was considerably less for the entire job than for the period from September 15 to October 8, when the timing device was in operation.

**Production Delays Analyzed.**—In Table III is given an analysis of the delays occurring during the entire paving period. Time losses are grouped into two divisions, major and minor. Major delays are those 15 minutes or more in length and minor delays are those less than 15 minutes in length. Minor delays usually occur much more frequently than major delays and generally far exceed the major delays in total time even though each may be less than a minute in length. These minor delays are usually the most serious consumers of profits. Major delays fall into two classes: those occurring with the full crew on the job and those occurring with the major portion of the crew laid off. Delays are classified as avoidable or unavoidable, and the efficiency of the organization is computed exclusive of the unavoidable delays. It is particularly interesting to note that on this project the major delays were all unavoidable and exceeded the minor delays which are believed to be mostly avoidable. The cost and difficulty of further reducing these minor delays would have been great and it is questionable if it could have been done. To illustrate clearly the cost of these time

**TABLE III—ANALYSIS OF DELAYS DURING ENTIRE PAVING PERIOD, AUG. 18 TO OCT. 8, 1930. TOTAL AVAILABLE WORKING DAYS DURING PERIOD, 42.50; TOTAL AVAILABLE HOURS, 340.50**

Item	Delay in hours	Per cent of total available time	Estimated cost
<b>Major delays—unavoidable:</b>			
Handling on grade.....	1.66	0.49	\$ 197.84
Crane repairs .....	.50	.15	59.59
Plant equipment repairs.....	4.62	1.36	550.61
Lack of asphalt .....	.75	.22	89.39
Power off .....	.25	.07	29.80
Electrical repairs .....	1.17	.34	139.44
Rain or wet grade (crew off job) .....	14.50	4.25	302.04
<b>Total .....</b>	<b>23.45</b>	<b>6.88</b>	<b>\$1,368.71</b>
<b>Minor delays—probably avoidable:</b>			
Truck operation .....	.22	.06	26.22
Lack of hot materials.....	3.14	.92	374.23
Operative delays .....	2.31	.68	275.31
Handling on grade.....	4.05	1.19	482.68
<b>Total .....</b>	<b>9.72</b>	<b>2.85</b>	<b>\$1,158.44</b>
<b>Grand total, all delays.....</b>	<b>33.17</b>	<b>9.73</b>	<b>\$2,527.15</b>

losses, they are evaluated at the rate of \$119.18 per hour, which is a conservative value for the normal personnel and organization employed, and the estimated cost is given in Table III. It should be noted that for the periods when the crew was not on the job the estimated cost of delay was not computed on this basis.



## Nationwide Survey of Airports Completed

Detailed knowledge of the needs of airports in connection with drainage and surfacing problems, and information as to present practices along these lines has been obtained from a first-hand study of approximately 100 representative airports throughout the United States undertaken by the Committee on Airport Drainage and Surfacing. This information, together with data secured from a variety of other sources, will be incorporated in the committee's report.

The Committee on Airport Drainage and Surfacing was organized about a year ago, and includes in its membership representatives of the American Engineering Council, the American Road Builders' Association and the Aeronautics Branch of the Department of Commerce.

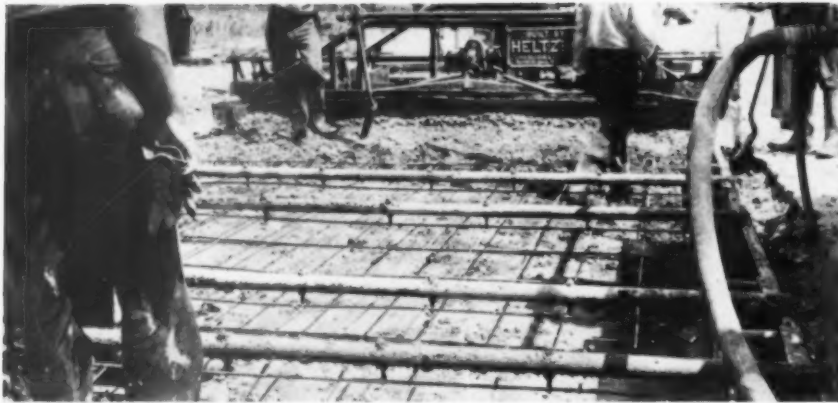
The sub-committee which has been appointed to draft the committee's preliminary report is headed by Fred E. Schnepfe, special research engineer for the committee, who conducted the field survey of airports, and the other members are C. A. Hogentogler of the American Engineering Council, C. N. Connor of the American Road Builders' Association and John E. Sommers, Aeronautics Branch.

Many detailed replies have been received to two questionnaires distributed by the committee. One of these questionnaires was sent to airport managers, and the other to 87 local engineering committees organized throughout the United States by the American Engineering Council and representing a total of about 450 engineers. In the organization of these committees the American Engineering Council sought particularly to include in their memberships drainage engineers, highway engineers, soil experts and airport engineers. The replies submitted by these bodies in answer to the committee's questionnaire are, in many cases, carefully prepared treatises on the subject.

Outstanding problems that have been given consideration by the committee include landing area requirements, grading, drainage, surfacing, runways, impact, surface textures, transition strips, turf and treatment of soils to increase stability.

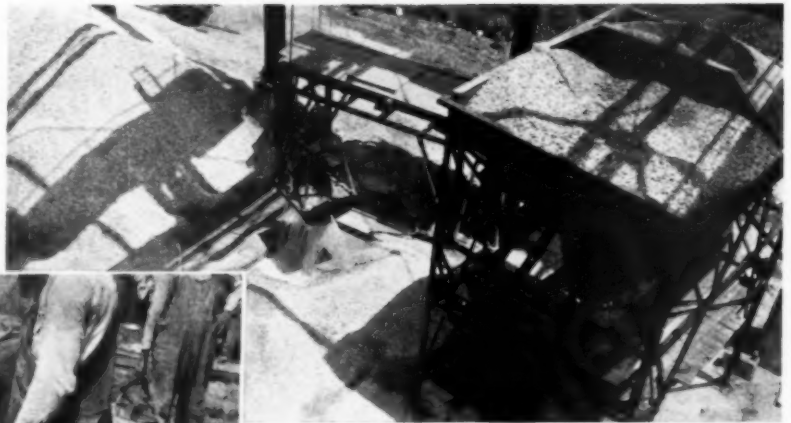
No attempt will be made to include in the report such general information as is available in books on agricultural, municipal or highway drainage or on the construction of surfaces for highways or city pavements other than that which may have some direct bearing in its application to airports. The design of airports is considered by the committee to be a subject so complex as to require the services of engineers who are particularly fitted by training and experience to handle such work, if satisfactory results are to be expected.

As the problems of adequate airport drainage and surfacing differ according to the nature of the soil and climatic conditions, the principles of construction for permanent surfacing and for drainage must be applied with local conditions in mind. Much valuable information as to conditions in various localities has been supplied to the committee by the local engineering committees.



Holding Steel in Place While Pouring Pavement Slab on Akron-Youngstown Road; E. C. Radabaugh, Contractor. Transverse Tube Has Several Long Radius Hooks That Hold Steel in Place While Ends Rest on Forms. After Concrete Is Placed Tube Is Rotated. The Hooks Disengage Themselves from Steel Leaving Tube Free to Be Removed

Below: Taking Yield Test on Athens-McArthur Road; F. E. Beckler, Contractor. Box Has a Capacity of Full Batch (5 Bags of  $1:7\frac{1}{2}$ ). It Is So Constructed to Enable the Concrete to Be Discharged from Bucket



Inundating Slag Before Batching on Akron-Youngstown Road; E. C. Radabaugh, Contractor. Slag Trucked from Plant and Dumped Into Pit Full of Water. Crane Raises Slag and Drains Free Water Before Placing in Batching Plant

Below: Central Mixing Plant on Dennison-Cadiz Road; W. L. Johnson Construction Co., Contractors. Aggregates Being Weighed in Batching Plant. Bulk Cement Being Weighed on Scales on Runway Just Outside of Car





# Cold Mix Paving in Greene, N. Y.

## Methods and Costs of Constructing 2,798 Sq. Yds. of Pavement

By C. O. MOODY

Sales Engineer, Koppers Products Co.

A small paving job recently completed at Greene, N. Y., illustrates the economical use of Tarmac and its applicability to work done by force account with comparatively inexperienced labor.

The work, under the supervision of Mr. George Chantler, Street Commissioner, consisted of a 12-in. gravel sub-base, a 3-in. compacted penetration base and a wearing course consisting of 1½ in. compacted of binder course material, finished with ½ in. compacted of fine top course material.

Three streets surfaced were: Jackson Street, from Chenango to Canal, approximately 485 feet long and 22 feet wide; Jackson Street, from Canal to Birdsall, approximately 556 feet long and 19 feet wide; and Driscoll Avenue, from Jackson to Main, approximately 358 feet long and 11 feet wide.

The streets were curbed and the gravel sub-base shaped to a crown, the same as the finished pavement. On this sub-base, 4 in. of No. 3 stone was laid loose, which was rolled to 3 in. This course was then given an application of 2 gal. to the square yard of Tarmac T and chinked with ¾ in. stone and thoroughly rolled.

**Method of Laying.**—We laid along the edge of the curb for a distance of about 75 ft., a 6 in. plank, 1 in. in thickness. Along the center of the street, parallel with the planks laid on the curb, we laid about 75 ft. of 6 in. planks, 1¼ in. in thickness. These planks were blocked in from each curb by the use of 2x4's. (See Fig. 2.) The material was then spread between the two edges of the planks, raked and finished by two men, using a 2x4 as a screed. (See Fig. 3.) This method of working can be easily used while the material is warm. When the material had been laid the length of the planks, the center planks were taken up and the job was started back on the other side, and the two sides were evened up. The center edge of the material already laid was used instead of the plank to level off the material. It is especially important that edges be maintained perpendicular at all times.

We used in this work three 1-yd. Ford dump trucks. The bodies of these trucks were sprayed, at the car, on each load, with a solution of kerosene and water, about 3 to 1. The men on the road also used this solution for dipping their rakes and shovels. This prevented the material caking on their implements. After each load the screed was also scraped and sprayed with this solution.

**Heating Material in Cars and Unloading.**—While the cold mix was handled readily without heat, we found that the slight additional cost of steaming cars is more than compensated for by increasing the ease of handling. In heating the cars, we used a battery of pipes in each end. The battery of pipes consists of 4 pipes, about 4½ ft. long; each of these pipes has several small holes drilled in them, about 6 in. apart. They are connected across the top with T's to a steam line. With a crowbar, we made holes through the material in the car and placed the battery of pipes in them. Very little pressure was needed in steaming the car. We found

that by leaving the battery in position for about an hour, with the steam valve just open, the material was sufficiently warm. The material was taken out of the car by using square faced shovels. In unloading a car it is essential that the face of the material be kept perpendicular and that the men shovel from the bottom. In this way, the material will feed itself to the men shoveling.

**Wages.**—The following is a list of the wages paid on this job: Laborers 40 ct. an hour; 1 yard Ford dump trucks, with driver \$1.40 an hour; roller, \$2.18 an hour, with roller man; foreman, \$5.00 a day.

**Costs.**—The accompanying tables on each of the three streets, show the various items of expense and show the total expenditure.

**Rolling.**—The material should be rolled as soon as possible after laying. We had this brought out particularly in the following manner. On Jackson St., from Chenango to Canal, we were unable to have a roller as we laid the street. We laid the material, however, and the roller was not used until 24 hours later. This necessitated, as shown by the tables of the two streets, 4 hours more rolling on Jackson St., from Chenango to Canal, than on Jackson St., from Canal to Birdsall, where the roller followed the work continuously and of the two streets, Jackson Street from Canal to Birdsall is the closer knit. It is essential that for work of this nature a 10-ton roller be used. It would have been practically impossible to smooth the material laid 24 hours with a roller lighter than 10 tons.

**Careful Workmanship.**—In laying the material the more even it can be laid the better the job looks after its initial rolling. For this reason the best men in any gang should be placed on the spreading work.

**Spreading Material.**—I found that it is much better to have men shovel the material from the back end of the trucks rather than have it dumped in small piles. Contrary to belief this is the quicker and more satisfactory method. If material is dumped directly from the truck, dumping boards should be used and the material rehandled in laying.

**Conclusions.**—The most interesting feature of this work was the fact that a paving job of this kind, in a small municipality, could be carried on satisfactorily with street forces who have not had previous experience in this type of construction, without special equipment, except the roller, which is ordinarily available in small communities.

Table I—Cost of Base

500 tons No. 3 stone at \$1.90 ton, f.o.b. Greene.....	\$ 950.00
Trucking and spreading No. 3 stone (time-book).....	442.80
Rolling No. 3 stone.....	58.86
Cost of tar applied.....	425.79
No. 2 stone in piles on road (approximately 70 tons)	232.90
Spreading No. 2 stone on tar.....	108.80
Rolling base.....	29.52
Truck for filling.....	18.90
Foreman .....	39.17
Total cost of base.....	\$2,306.74
Cost per square yard of base.....	\$0.8244



Table II—Costs on Jackson St.—Canal to Birdsall

Days	Sq. yd. of material	Cost of material	No. of tons spread	No. of hours labor at cars	Cost of unloading at cars	No. of truck hours	Cost of trucks	No. of hours labor spreading	Cost of spreading	No. of hours rolling	Cost of rolling	No. of hours steam	Cost of steam	Miscellaneous	Foreman
Friday .....	1,174	\$374.10	58	24½	\$ 9.80	15	\$21.00	35	\$14.00	1	\$ 2.18	5	\$ 2.50		\$ 2.76
Monday .....				45	18.00	27	37.80	63	25.20	4	8.72	9	4.50		5.00
Tuesday .....				35	14.00	21	29.40	49	19.60	4	8.72	7	3.50		5.00
Wednesday .....										6	13.08				
Total .....	1,174	\$374.10	58	104½	\$41.80	63	\$88.20	147	\$58.80	15	\$32.70	21	\$10.50		\$12.80
Cost of top.....						\$618.90	Square yards per ton of material.....								20.241
Cost per square yard.....						\$ 0.527	Cost per square yard unloading.....								\$0.0356
Cost per ton unloading.....						\$ 0.72	Cost per square yard spreading.....								\$0.05
Cost per ton spreading.....						\$ 1.013	Cost per square yard trucking.....								\$0.0751



Fig. 3—Jackson St. from Canal to Birdsall, Also Shows Laying of the Cold Mix



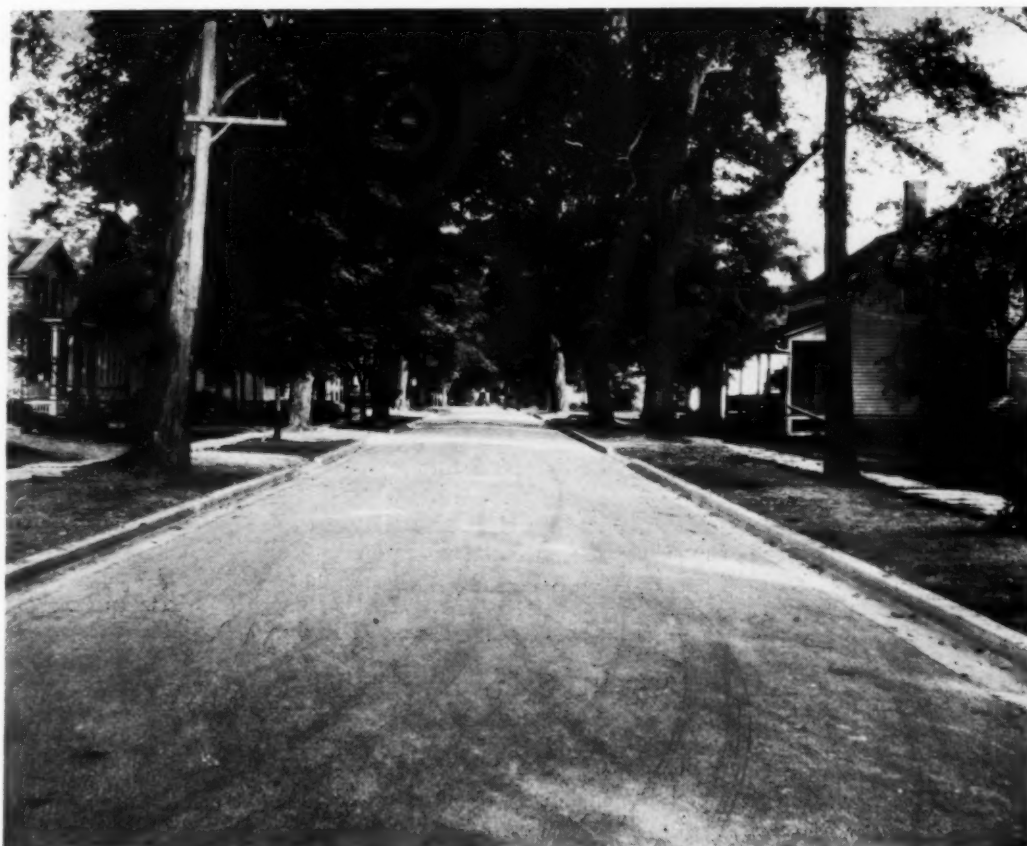
Fig. 1—Jackson St., from Canal to Birdsall, with the No. 3 Stone in Place, Ready for Tar Application



Fig. 2—Jackson St., from Canal to Birdsall After the Tar Had Been Applied and the No. 2 Stone Spread and Rolled. View Also Shows the Forms in Place, Prior to Spreading Cold Mix



**Table III—Costs on Driscoll St.—Jackson to Main**

[illegible]

*Fig. 4—Jackson St. Just After the Work Was Completed*

**Table IV—Costs on Jackson St.—Chenango to Canal**

[illegible]

Table V—Recapitulation

Days	Sq. yd. of material	Cost of material	No. of tons spread	No. of hours labor at cars	Cost of unloading at cars	No. of truck hours	Cost of trucks	No. of hours labor spreading	Cost of spreading	No. of hours rolling	Cost of rolling	No. of hours steam	Cost of steam	Miscellaneous	Foreman
Monday	1,186	\$387.00	60												
Tuesday				7½	\$ 3.00	3	\$ 5.20	10	\$ 4.00			4	\$2.00	\$5	\$ 0.83
Wednesday	438	141.90	22	36	14.40	19½	27.30	54	21.60	3	\$ 6.54	9	4.50		5.00
Thursday				45	18.00	27	37.80	63	25.20			9	4.50	1	5.00
Friday	1,174	374.10	58	40½	16.20	27	37.80	63	25.20	10	21.80	9	4.50		5.00
Monday				45	18.00	27	37.80	63	25.20	9	19.62	9	4.50		5.00
Tuesday				35	14.00	21	29.40	49	19.60	9	19.62	7	3.50		5.00
Wednesday										9	19.62				
Totals	2,798	\$903.00	140	209	\$83.60	124½	\$175.30	302	\$120.80	40	\$87.20	47	\$23.50	\$6	\$25.83
Cost of top						\$1,425.23									\$ 0.02984
Cost of base						\$2,306.74									\$ 0.04317
Total cost of streets						\$3,731.97									\$ 0.06265
Cost per square yard (total)						\$ 1.3338									\$ 0.5094
Cost per ton unloading						\$ 0.597									\$ 0.03116
Cost per ton spreading						\$ 0.8628									\$ 0.0084
Square yards per ton of material						19.985									

## Raiding the Gas Tax

With the convening of the state legislature the annual attempts to divert from their proper and legal objectives funds derived from the gasoline tax blossom forth again. Occasionally these gas-tax raids are attempted for the benefit of other than strictly highway projects. More often they seek to shift the revenue of less populous counties.

About half a dozen such schemes are expected to be advanced with more or less plausibility at Sacramento this month. Among the announced plans are the taking of \$5,000,000 from the gross receipts for separation of railroad grade crossings on county roads and city streets; a larger share of secondary State highway construction funds allotted to joint county highway districts, in place of the present 10 per cent; allocation of 1 cent of the present tax to cities for street development; contribution from the funds to special assessment districts, and the payment of interest on outstanding highway bonds from the gasoline fund, instead of general revenues.

There are valid objections to each one of these proposals, superficially attractive as some of them seem. The principal objection to all such proposals is that it is the major highways which need most attention, and that until these are more nearly completed the revenues should not be scattered upon minor projects. Major highways, of course, include thoroughfares in incorporated communities essential as part of the larger highway scheme in facilitating inter-city traffic.

The Automobile Club of Southern California has made a careful study of all such proposals and believes the end to be sought—that of concentrating county highway revenues upon primary county highways—may be attained by budgeting the expenditure of the counties' share of the gas tax and registration fees with the approval of the state director of public works, or by requiring each county to submit a primary highway plan to be approved by the state director and restricting revenues to carrying out such plan. The second plan would give a measure of county autonomy, but with central supervision so that the system of county highways would bear its proper relation to the state highway system and would be complete as far as it goes.

Either plan would permit the use of funds for elimination of grade crossings, aid to special assessment districts, and so on, where these are of real public importance, thus accomplishing the good sought in the raiding

proposals, without dissipating the money upon log-rolling schemes.

The plan for paying interest upon existing highway bonds from gas-tax revenues is objectionable upon the broad ground of public policy. The entire burden of building and maintaining roads and streets should not be placed upon motorists, since they do not receive all the benefits. All property is enhanced in value by a good and comprehensive highway system, and where property benefits it should, in equity, be taxed correspondingly for that which produces the benefit. It is not likely that further highway bonds will be issued by the state of California, but those now issued should be maintained and paid off in the manner originally planned.

While some states have a higher gasoline tax than California, some of the major motoring states, including New York, Connecticut and Massachusetts, have a 2-cent rate, and Pennsylvania will reduce her rate this year from 4 cents to 3. The 3-cent states are Delaware, Illinois, Iowa, Kansas, Michigan, Minnesota, North Dakota and Washington, in addition to this one, and New Jersey is expected to go on a 3-cent rate this year; its present rate is 2. The highest rates are found only in the southern states, where the raiders have succeeded in taxing motorists for the support of schools and for other projects that obviously ought to be paid for from general taxation.

California should go very slow in modifying her gasoline tax plan and should make changes only in the direction of better concentration upon necessary projects. All the dissipation plans should be cast into the discard.

*Acknowledgement.*—From the *Los Angeles Times*.

## Government Statistics of the Cement Industry for the Month of July

American Portland cement mills still show a decline in the ratio of operations to capacity as indicated by the figures for the twelve months' period ending July 31. According to statistics just released by the Bureau of Mines of the Department of Commerce, the ratio of operations to capacity for the last twelve months was 53.8 per cent.

During the month 13,899,000 barrels were produced, 15,545,000 barrels were shipped, and stocks on hand at the end of the month were 25,957,000. Production in July, 1931, was 18.6 per cent less and shipments 22.9 per cent less than in July, 1930. Stocks at the mills were 1.3 per cent less than a year ago.



# Building Architectural Beauty Into a Viaduct

By H. L. FLODIN

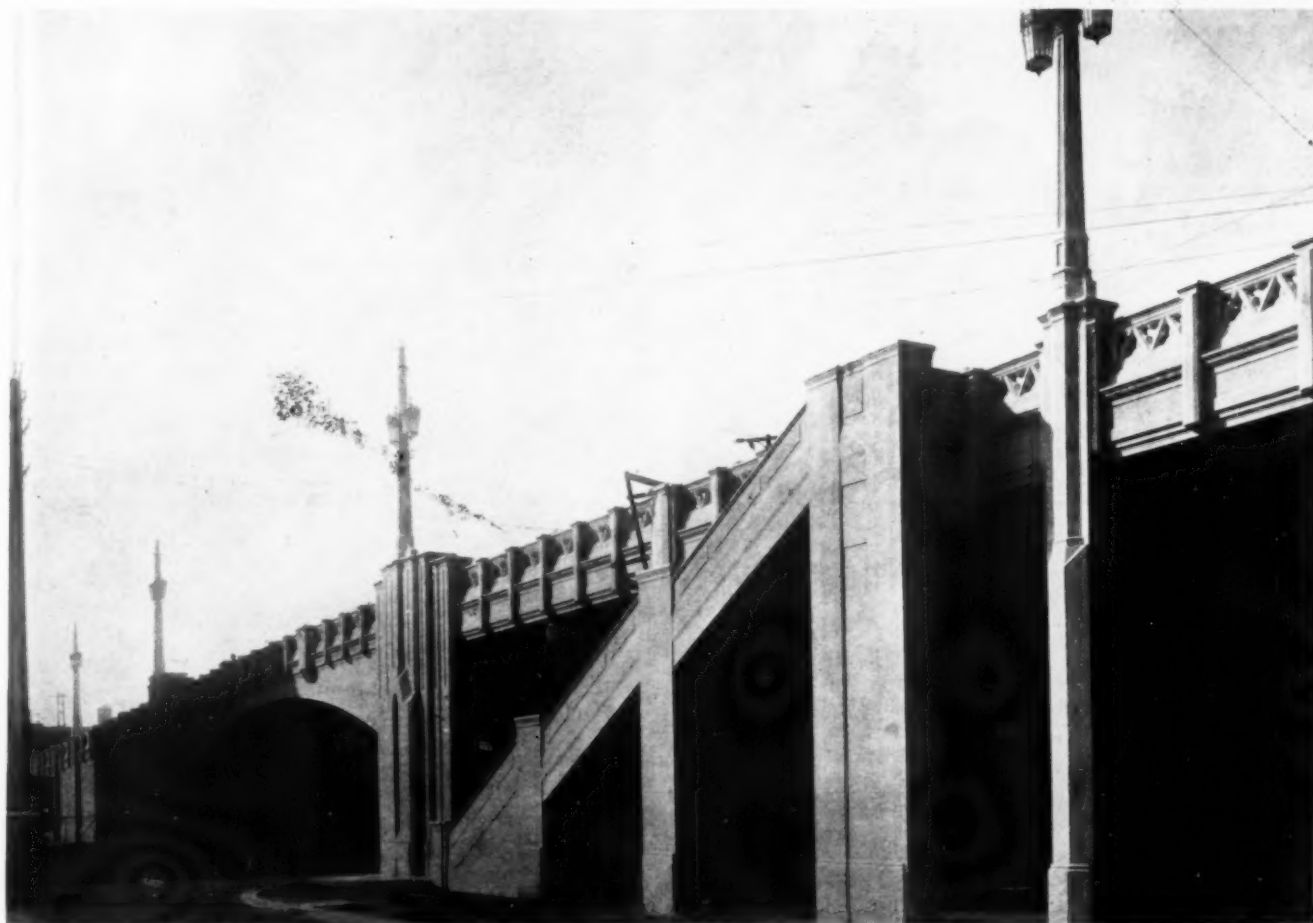
**T**HE Fourth St. viaduct in Los Angeles illustrates the progress that is taking place in making purely utilitarian structures more attractive by combining architectural design with engineering requirements.

*General Features.*—The viaduct, which was recently opened, carries traffic over several streets, the tracks of the Santa Fe and Union Pacific Railroads and the Los Angeles River. It combines several types of structural design. An arch span of 254 ft. was provided over the river to give an unobstructed channel. To provide clearance over the railroad tracks a series of girder spans 63 ft. in the clear were used. The soffits of these girders near the river were cambered to give the appearance of very flat arches to harmonize with the arched sections of the viaduct which include the river arch and a series of flat arches over the streets. The latter are rigid frames with vertical legs and curved top beams. The importance of the river arch as the central feature was emphasized by pylons extending 40 ft. above the sidewalk at either end of the arch section.

*Design Features.*—Merrill Butler, Engineer of Bridges, Los Angeles, recently spoke of the architecture as follows:

"Because of the different types of structural design used it was deemed advisable to divide the structure into different parts by emphasizing the vertical elements at the main abutments separating the different sections. This accentuation of vertical lines was carried into the handrail, providing a vertical motif instead of the horizontal emphasis naturally produced by a succession of horizontal elements. It was in the determination of these essential features that the architectural treatment of the structure as a whole was developed. The vertical lines of Gothic stonework were simplified into a severely plain treatment, quite in keeping with the massive concrete structure to be embellished.

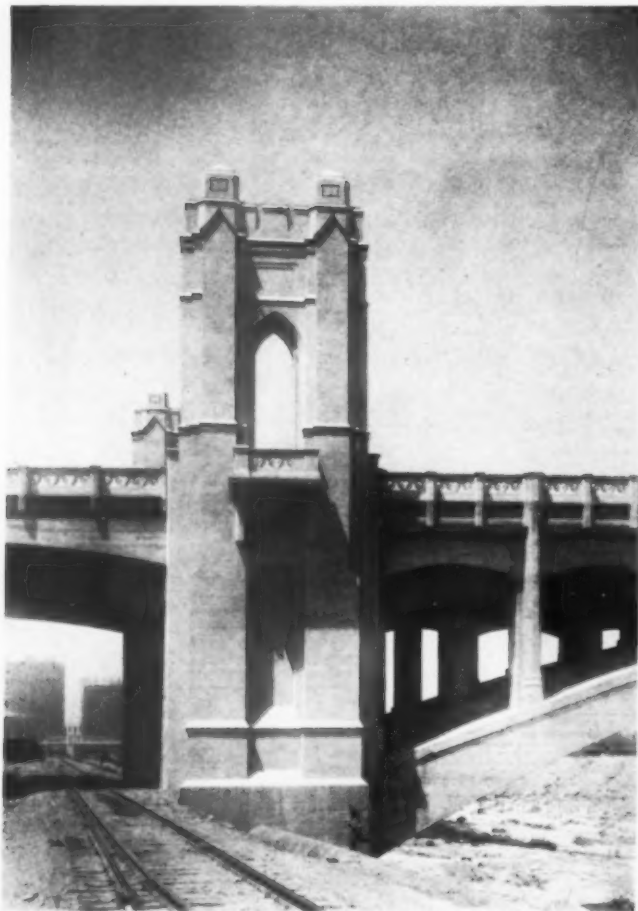
"The precast concrete panels of the handrail, while expressing Gothic ornament, were designed to facilitate quantity production, but are in fact not Gothic. The vertical elements of the handrail are carried up into the ornamental bases of the precast concrete lighting standards. The lanterns are designed to harmonize with the remainder of the structure and yet carry ornamentation to its greatest elaboration. They are cast in aluminum and are the first viaduct lighting units to



View Showing Flat Arch Span Over a Street, Girder Span Over Railway Tracks and Stairway. Vertical Lines in Pylons at Street Intersections Carry Out the Gothic Motif of the Larger Pylons and Handrail



*Arch Span Across the Los Angeles River. Tall Pylons at Each End of the Span Make This the Central Feature of the Viaduct. All Surfaces Are Concrete with No Attempt Made to Obliterate Form Marks*



*Detail of Pylon. Finished Tongue and Groove Lumber in Carefully Constructed Forms Have Produced Surfaces of Attractive Appearance. There Is a Total Absence of Fill Planes or Construction Joints*



*In the Walls of the Approaches Simple Panels Were Introduced by Nailing Strips of Wood to the Forms. Vertical Lines Were Produced in the Same Manner. Note Total Absence of Visible Construction Joints*

be made of that metal. They harmonize with the natural concrete in the structure better than if they were cast in bronze.

"All concrete in the Fourth St. viaduct, whether cast in place or precast, has been left with the natural concrete surface. No surfaces are plastered, but they have



*Detail of Lighting Standard and Seats. Lighting Standard Is Precast Concrete with Cast Aluminum Lanterns. Tight Forms of Dressed Lumber Are Necessary to Produce Such Perfect Concrete. This Surface Has Been Slightly Smoothed with Carborundum*

been smoothed up in places with carborundum, air grinders being used. Extreme care was taken in making all forms, to secure true surfaces and the results were uniformly satisfactory. A very high quality of concrete was obtained on the job, the average strength of 214 samples tested being 3711 pounds per square inch under compression at 28 days."

**The Form Work.**—The illustrations show the pleasing results obtained where the texture produced by the form marks becomes part of the architectural treatment. To secure such satisfactory results it is necessary to follow certain methods that have been found from experience to be best. Only dressed tongue and groove lumber is used in building the forms for this type of work. Since the texture will vary with the width of the form boards, a width must be selected which is most suitable for the size and type of structure and the effect desired. Generally a board 6 in. wide giving an exposure of 5½ in. gives an attractive texture. The forms must be well braced to keep alignment and must be tight at the time concrete is placed. Tight forms are essential as any leakage will produce

sand streaks on the surface which are unsightly and difficult to patch. Where forms have become dried out they must be wetted several times in advance of placing concrete to tighten them.

**Concreting Methods.**—Proportioning the mix and placing concrete require somewhat more attention to small details than is ordinarily given. Segregation of materials will result in honeycombing, water-gain near the top of the lift and concrete that is not uniform. A mixture of a sticky nature with enough sand-cement mortar to hold the mass together will give the best results. Engineers and architects now recognize the importance of limiting the mixing water to produce quality concrete and for this type of work generally specify 6 gal. of water per sack of cement including the water carried by the aggregates. The enforcement of this specification is important in structures such as bridges and viaducts where the surface exposed is large in proportion to the volume of concrete.

During placing the concrete is well spaded along the surface of the forms to remove air pockets and consolidate the mass. The upper surface is kept as horizontal as possible by placing in thin layers. This avoids the possible formation of fill planes at an angle to the form lines which would introduce lines that are not desired in this texture. Construction joints require careful attention and are made to coincide with one of the board marks. Where a construction joint is to be made a wood strip 1x2 in. is nailed on the inside of the form. Concrete is placed to the top of this strip. When the concrete has hardened the strip is removed, leaving a level smooth surface along the form. The joint will then appear as a thin straight line at the form board mark and will not be visible from the distance the structure is generally viewed.

These methods were followed by the contractors in building the Fourth St. viaduct with the satisfactory results seen in the illustration. The project was under the direction of the Board of Public Works of the City of Los Angeles. J. J. Jessup is city engineer; Merrill Butler, Engineer of Bridges and Structures; H. P. Cortelyou, Engineer of Construction for the city. Fisher, Ross, MacDonald and Kahn, Inc., Los Angeles, were the general contractors.

## Weeds Go; Appearance Improves



*Tractor-Mower Outfit Cutting a 6-Ft. Swath Through Roadside Weeds at Kickapoo, Ill.*



## Finishing Machine Used on Ohio Black Top

**F**INISHING machines are being used by the Federal Asphalt Paving Co., Hamilton, O., on the construction of 2-course black top on Route 16 between Hanover and Newark, O., resulting in the securing of smoother surfaces and lower labor costs. The first part of the 20 ft. road was laid in half width but on the remainder of the work the full 20 ft. width operation was carried on.

The plant capacity limits production to approximately 325 tons in 8 hours with the following labor force:

On Base

- 4 shovellers
- 1 machine operator
- 1 back raker on top
- 3 shovellers
- 1 machine operator
- 1 back raker
- 1 man handling compression strips

If the base course had been more uniform in thickness, one shoveller on both base and top could have been eliminated. Excellent progress has been made with the



Fig. 1—Finishing Machines on Base Course, Half Width Construction



Fig. 2—Finishing Machine on Top Course with Spreader in Use

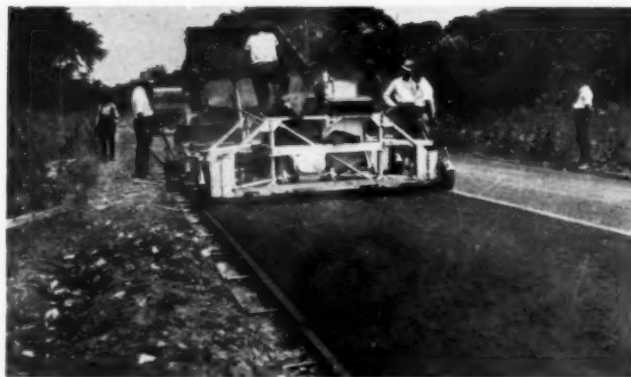


Fig. 3—Rear View of Operation Shown in Fig. 2

work. On one day, July 25, 1040 ft. of top course 1 in. thick was laid in a little over 3 hours.

The accompanying illustrations show how the Lakewood finishing machine was used on this work. Figure 1 shows the finishing machine on the base, half width construction, prior to the use of the spreader box. At the left is the special center form of steel plate with bar welded thereto which was spiked to the old road.

Figure 2 shows the operation on the second half, the finishing machine working on the top course with



Fig. 4—Full Width 20 Ft. Operation

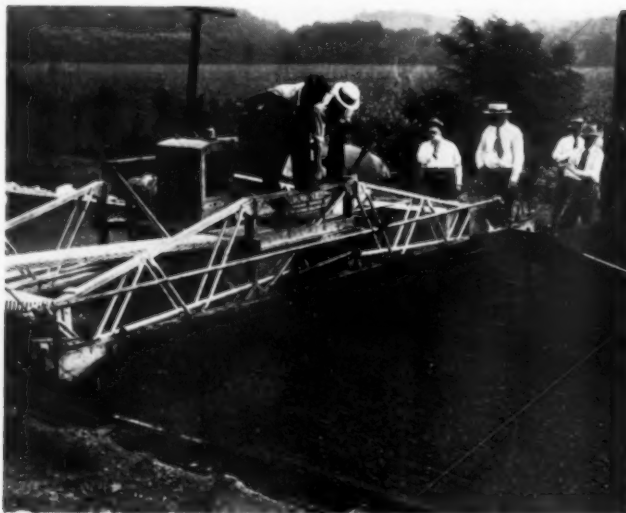


Fig. 5—Full Width Operation on Base Course



Fig. 6—Another View of Full Width Construction

spreader box in use. On the second half it was found that no form was necessary as a flat wheel rode the finished half of the pavement and a special asphalt screed with vertical adjustable end shoes raised the center section to allow for compression.

Figure 3 is a rear view of the operation shown in Fig. 2. Note the 3-in. steel forms on left hand side. Note compression strip used only in conjunction with spreading the top and which was laid on 3 in. form. Four or five of these strips were used.

Figure 4 shows the full width, 20 ft. operation. A rough levelling course was laid ahead of the finishing machine operation where necessary to correct bad depressions in pavement or at points where crown was excessive so as to make the binder course more uniform in thickness under screed member.

Figure 5 shows full width operation on the base course. Note spreader box at right ready to be pulled forward.

Figure 6 also shows full width construction with the roller on base course.



### American Society of Municipal Engineers Convene

The thirty-seventh annual convention of the American Society of Municipal Engineers will be held in Pittsburgh, Pa., October 19th to 23rd inclusive, with headquarters at the Hotel William Penn.

This meeting promises to be one of the most important gatherings of its kind ever held, and an exceptionally large attendance is expected from all parts of the country.

The manufacturers' exhibit is expected to be larger than ever, and will include many exhibitors who have not previously shown at the convention. We are certain that the educational value of this exhibit will be appreciated by those interested in municipal engineering, as well as by the manufacturer.

**GRADE-CROSSING ELIMINATION.**—If the present rate of eliminating grade crossings in California is continued, practically all dangerous main-line crossings on the state highway system should be eliminated in the next 10 years.

### North Dakota's Experience with Magnetic Road Sweeper

During 1930 the state highway department of North Dakota purchased a magnetic road sweeper for use on its gravelled roads. The electrical part of the unit consists of three magnets with a gasoline engine and generator. These are mounted on a 1-ton truck. One magnet hangs from the rear end of the truck and one each side in front of the rear wheels. A strip approximately 9 ft. wide is covered on each trip so it takes three trips to cover completely a 24-ft. roadway. Some interesting information on the operation of this machine in 1930 and 1931 is given in the July bulletin of the state highway department.

The outfit travelling at about six miles per hour can clean up from 16 to 20 miles per day. The total cost of operation including depreciation is about \$1.25 per mile of roadway swept.

In 1930, 1,172 miles of gravelled highways were covered and 13,891 lb. of metal was picked up. This was an average of 11.9 lb. per mile. From April 9th to June 30th, 1931, the machine had swept 1,235 miles, collecting 11,194 lb. of metal, or an average of 9.06 lb. per mile, or 76.1 per cent of the amount collected on the first year's sweeping.

Of course not all the metal collected is potential puncture making material. Parts of springs, bolts, tools, bottle caps, etc., comprise quite a large percentage of the weight. However, in a single pound of material collected, as high as 330 potential puncture making objects were found, such as nails, tacks, brads and screws.

Inquiries at tire repair shops show that the puncture business drops off about 40 to 50 per cent after the nail picker has been along and this in spite of the fact that only the gravelled state highways are covered by the machine.

On roads carrying 300 vehicles per day average throughout the year a total of 109,500 vehicle miles would be travelled per mile. As this service costs only \$1.25 per mile the cost per vehicle mile swept is only slightly over 1/1,000 of a cent per vehicle mile.

Not all metal is removed on one sweeping even though the magnets will draw a loose nail through approximately 3 in. of dry loose gravel. Not all punctures will be prevented, but the chances of a puncture are very greatly reduced and at a surprisingly low cost.



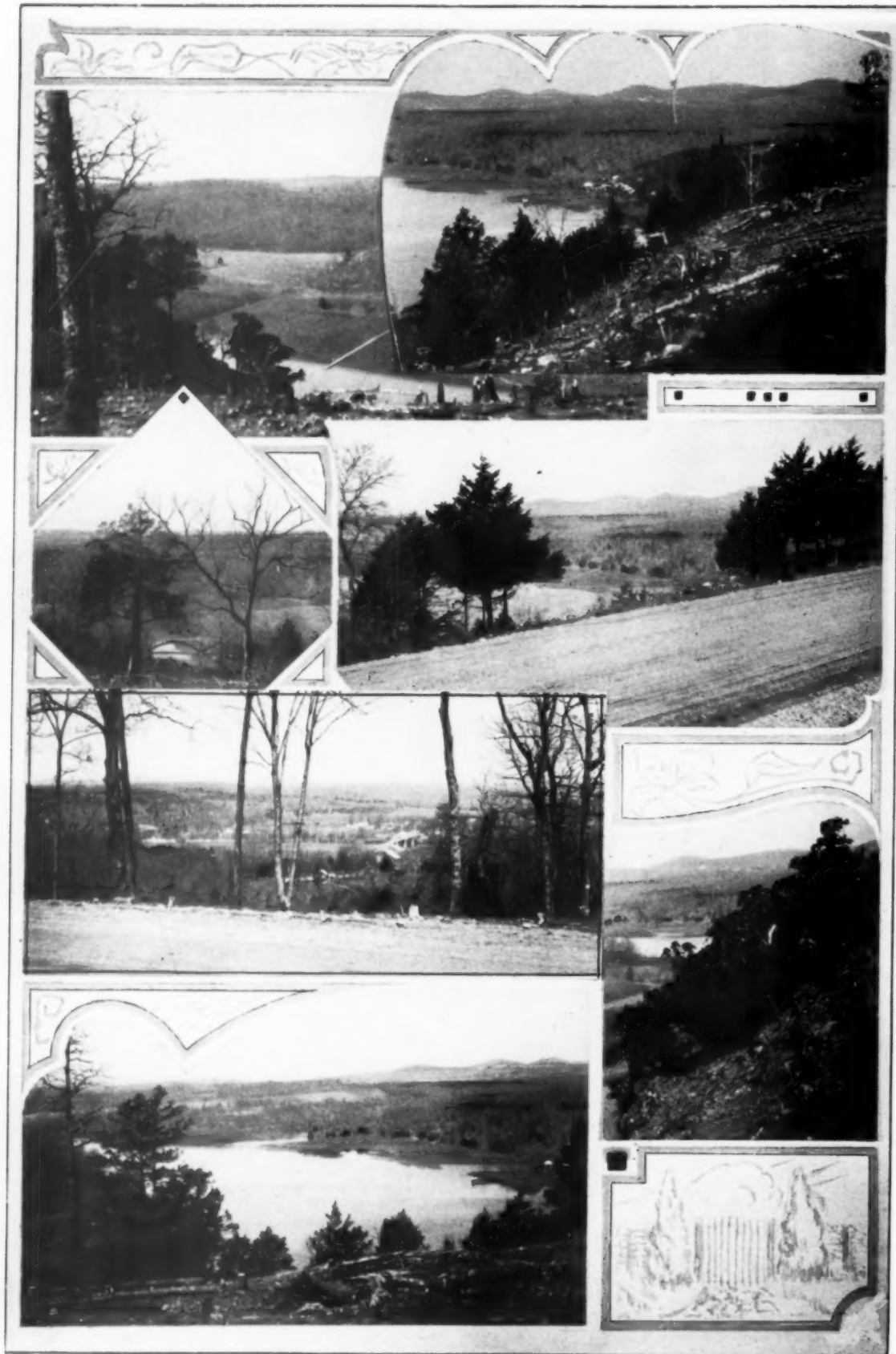
### Worse Than War

The Travelers' Insurance Company of Hartford, Conn., has issued a book of statistics and facts which shows that more people died in the United States in the past eighteen months from automobile accidents than we lost during the entire World War. Of the 32,500 killed in 1930, over 45 per cent of that number resulted from the collision of motor vehicles with pedestrians, the drivers of automobiles being responsible for three-fourths of the accidents.

Over 27 per cent of the fatalities to pedestrians occurred from crossing between intersections. Fifteen per cent of the pedestrian fatalities were the result of children playing in the street, while over ten per cent were due from coming from behind a parked car. In more than 80 per cent of child fatalities the children were walking or running across the street.

Fifty-seven per cent of the accidents to which pedestrians contributed happened at street intersections and more than 40 per cent of all motor vehicle accidents causing death occurred at street intersections.

## *Scenic Grandeur Revealed By Proper Tree Trimming*



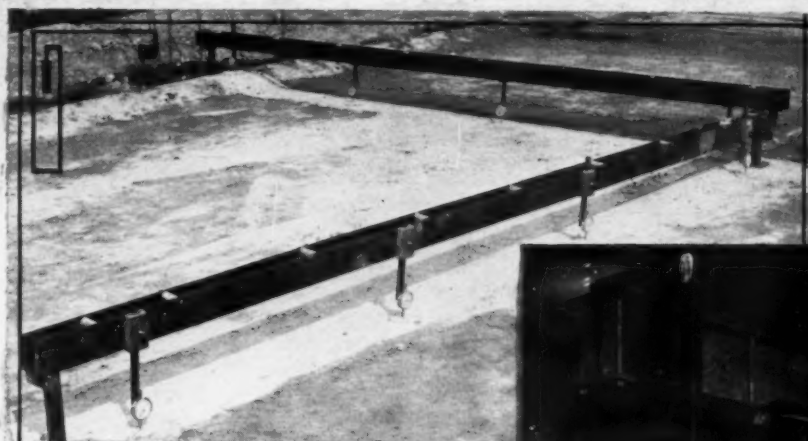
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*Pictures by courtesy of Missouri State Highway Department*



# Special Material Testing and Research Equipment

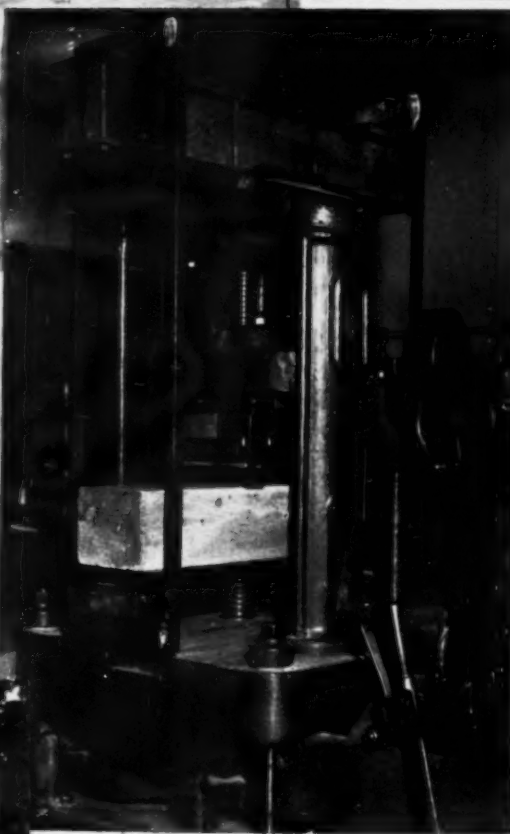
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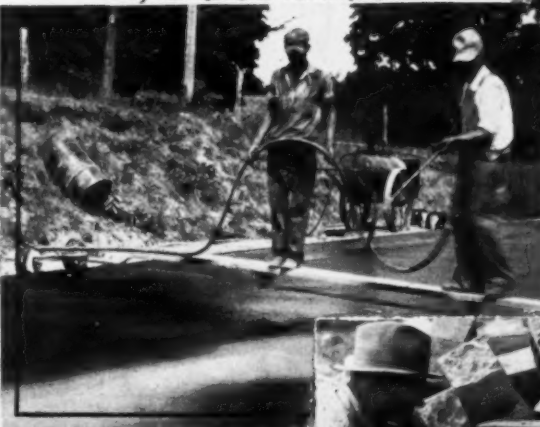
Apparatus  
for measuring  
warping of  
Concrete  
Pavement



Core Drill taking samples  
of Concrete Pavement



Testing specimen of Concrete for  
strength  
Curing Concrete Pavement by  
coating with bituminous emulsion



Testing specimen of  
Concrete Pavement  
for strength





elevation of point *C* to obtain the elevation of the pivotal point *H*. (Note, that in plan, point *H* coincides with point *E*<sub>1</sub> at the beginning of the transition, section *B-B*, and that at the point of maximum widening, section *E-E*, it is farthest from *E*<sub>1</sub>.)

Third. Read the rate of superelevation in feet per foot width of pavement for the full circular curve involved from the standards. Using this rate for width ( $W+w$ ), find the elevation of point *E*<sub>2</sub>. Extrapolate for elevations *G*<sub>1</sub> and *G*<sub>2</sub>, *G*<sub>1</sub>-*H*-*E*<sub>2</sub>-*G*<sub>2</sub> is a straight line for all sections except at *B-B* and within a short distance therefrom, within which intervals the crown merges into a straight superelevated surface.

Fourth. The profile of the inner edge of the pavement from the point *E*<sub>1</sub> to the point *H* is parallel with the grade line within this 150 ft. interval. The profile of the outer edge of the pavement from points *E*<sub>2</sub> to *E*<sub>1</sub> varies uniformly.

Fifth. Having these control points on any section find the rate of superelevation on the transition, and extrapolate as above.

## Street and Highway Traffic Problems To Be Discussed

An important general conference for the consideration of safety problems of municipalities, and especially relating to street and highway traffic, will be held at The Stevens Hotel in Chicago from Oct. 12 to 16 as an important part of the Twentieth Annual Safety Congress and Exposition.

This program will include special sessions on community safety, street and highway traffic, a four day traffic school, a traffic demonstration, and a traffic observation tour.

There will be hundreds of delegates from municipal and state and government departments, and the speakers will include many national authorities in their respective fields. The program will center in the sessions of the Street and Highway Traffic Section, which is one of the most important and most rapidly growing co-operative Sections of the National Safety Council. This program will begin on Monday afternoon, the first day of the Congress and will carry through until Friday noon, the last day of the congress.

The topic for the Tuesday morning general session will be, "Hazardous Street Locations." J. W. A. Bollong, Seattle Traffic Engineer, will discuss "Discovering Hazardous Locations." "What the Collision Diagram Shows" will be discussed by speaker to be announced. On Tuesday afternoon there will be a "Traffic Demonstration in Grant Park" which will include a display of traffic control systems, vehicle tests and testing equipment, and an Accident Investigation Squad at work.

The general topic for Friday morning will be "Traffic Legislation." Dr. Miller McClintock, Director, Erskine Bureau for Street Traffic Research, Harvard University, will discuss "Adapting the Model Ordinance to Your City." Harold G. Hoffman, Commissioner of Motor Vehicles of New Jersey, will talk on "The State Responsibility for Uniformity of Traffic." Howard D. Brown, Automobile Club of Michigan, Detroit, will talk on "How Michigan Passed the Drivers' License Law." Dr. Earle G. Brown, Secretary, Kansas State Board of Health will talk on "How Kansas Passed the Drivers' License Law."

One of the important supplementary programs will be the "Traffic School," at an early morning hour from Tuesday to Friday. At the first session Maxwell N.

Halsey, Traffic Engineer, National Bureau of Casualty and Surety Underwriters will talk on "What Has Parking Limitation Accomplished?" The Wednesday topic will be "Accident Clinic" by Hawley S. Simpson, Research Engineer, American Electric Railway Association. The Thursday topic will be "Training Traffic Police" by a speaker to be announced. On Friday, Ernest P. Goodrich, President, Institute of Traffic Engineers will talk on "Traffic Signals and Accidents."

One of the features of the congress will be the annual safety exposition in the large exhibit hall of The Stevens Hotel, with displays by more than 100 exhibitors.

## Street Cleaning at St. Paul, Minn.

The city of St. Paul, Minn., has 426 miles of streets graded only, 233 miles of paved streets and 20 miles of paved alleys. The annual report of John H. McDonald, commissioner of public works, gave the following information on the cleaning of the streets in 1930:

The paved areas—streets, bridges and alleys—amount to 5,500,000 sq. yd. Of the paved streets, 61 miles are cleaned by hand sweeping under a patrol system, the district for each sweeper varying from 3,500 sq. yd. in the business district to 20,000 sq. yd. in the residential district.

Snow removal amounted to \$40,656 and the sanding of walks and steps in icy weather, \$3,578. For snow removal the street railway company paid a substantial sum.

In addition to the sweeping service all paved streets are cleaned with water periodically. This is done exclusively with auto flushers, the horse-drawn flushers having been replaced by two auto flushers.

In the commercial district 7.441 miles of streets are flushed every night. In the outlying streets and on arterial streets flushing is done as required, 23,290 miles being flushed twice a week and 163.825 miles being flushed once a week.

Where dust was laid by flushing the following rates were used: night flushing, daily, 14 ct. per frontage foot; flushing twice a week, 5 ct. per frontage foot; flushing once a week, 2.5 ct. per frontage foot.

In line with a policy established during the latter part of the 1928 season no water sprinkling service was rendered during the season of 1929. Complaints regarding the discontinuance of this class of service were few, indicating that the average property owner is becoming reconciled to the fact that it is an obsolete and inefficient method of dust prevention.

A total of 1,648,420 gal. of road oil was used in treating 324 miles of street. This is an increase of 53 miles over last season, due largely to the following-out of the recommendation of the bureau of health that all dirt streets be oiled as a health measure.

Property was assessed on the basis of one oiling, on the theory that property which fronts on a street of such composition that two oilings are required to put it into a condition which one oiling would ordinarily accomplish is only benefited to the extent of one oiling. The rate for oiling an average width of 24 ft. was 3.12 ct. per front foot or \$1.25 per 40-ft. lot. Altogether, 67,485 lots or parcels were assessed for flushing and oiling. As some lots are assessed for both classes of service and corner lots are assessed separately for each street, the total of separate assessments amounted to \$78,072.



## EDITORIALS

### *How Latent Demand Was Converted Into Actual Demand for Paved Highways*

IT IS being urged that the only permanent relief from unemployment will be the adoption of the 30-hour week. The argument rests upon the fact that improved machinery has greatly increased the output of American workers during the past 10 years. Those who use this argument are apparently not aware that the increase in per capita efficiency during the last decade was not abnormally great. During the last century that increase has been 400 per cent. A century ago the working week was about 66 hours. It is now about 48 hours, whereas it should be less than 16 hours now were there any truth in the theory that the only solution of the unemployment problem is a sufficient reduction in the working hours to offset the increase in productive output.

Looking back at the primitive life in America a century ago—the log cabins in which many of our great men were born—we see that the average American has been raised from poverty to affluence as a result of his greatly increased productivity. If the affluence that has resulted from scientific progress is entirely satisfactory, then there is sound reason in urging a 25 per cent reduction in working hours every decade, in order fully to offset the increasing per capita output. When presented thus, it becomes obvious that the proposed solution of the unemployment problem by reduction in working hours is not a satisfactory solution.

We are not urging that working hours should remain unchanged. On the contrary we believe that the 40-hour week will be almost universal in America within a few years. In fact many an office and many a plant in which the 40-hour week was adopted when the present depression became pronounced, will not return to a longer working week when the depression ends.

In order to increase "real wages," there is but one way—increased per capita output. But this does not mean equal increments in every branch of industry. If the average person is comfortably and even elegantly shod with three pairs of shoes a year, it is economic folly to increase the output to four pairs. If the average American is well fed, it becomes a pure waste of energy to produce more food for domestic consumption. Yet such forms of economic folly have been all too common, and account in large measure, for the periodic crises in the business cycle.

American farmers, after the recent bitter experiences from overproduction of wheat, cotton, etc., begin to realize that there is no solution of their great problem except restriction of output. How to bring this about is a serious question.

Producers of petroleum are even more convinced than farmers that their economic difficulties spring primarily from glutting the market. Steel and cement manufacturers have long realized that the capacities of their plants so far exceed the demands for their products that there should be radical curtailment of further increases in capacity unless the demand can be enhanced. Yet steel and cement are products for which the latent demand is great. Who, for example, would not prefer to live in a fire-proof house instead of a

frame building? The average American residence, as Chesterton recently remarked, is an ugly abode. In addition it is uncomfortably small, excessively hot in summer and not always warm enough in winter. It would require no great effort to convert the latent demand for better houses into an active demand. Many decades of rebuilding could be brought about.

Manufacturers of building materials are doing pitifully little to arouse this latent demand. Look at any newspaper or general magazine if you doubt it, and contrast the space occupied by advertisements of motorcars with that occupied by cement advertisements. Recently the manager of a great cement plant told the writer that there was really no more reason why his company should advertise cement than why a farmer should advertise his wheat. Both are standard products, he argued, and nothing is gained by the advertiser through advertising a standard product. This point of view is typical of the man who has no adequate conception of latent demand. For wheat there is no latent demand. For cement the latent demand is enormous; but so long as the cement manufacturers fail to realize this difference, they will probably continue to do very little to increase the demand for their product.

The architectural magazines of this country carry almost as little advertising relating to cement as to wheat. Yet those magazines are among the most potent means of developing latent demand for cement.

ROADS AND STREETS was an early and persistent advocate of federal and state aid in highway construction, and later fostered the gasoline tax as a means of increasing revenues for road work. Yet at the present time it carries no advertisement of any cement company, although it is the leading highway magazine. If the technical periodicals that are devoted to construction do not receive adequate advertising support from cement manufacturers what need the general magazines and newspapers expect?

We have selected cement as an illustration, because it is a product whose sales have increased enormously within the last 20 years in spite of the relatively slight efforts made by the cement companies to promote more extensive use of cement. Cement companies have the automobile and the road magazines to thank for the conversion of latent into actual demand for paved roads. The automobile has been advertised as no other high-priced product was ever advertised. The resulting sales put America on wheels with "no place to go" where dust and mud were absent. A demand for paved roads began to be heard. ROADS AND STREETS started an editorial campaign for federal and state aid in the highway field. Later a gasoline tax was advocated. These two measures were popularized by wide and continuous dissemination of articles sent to daily papers. With great rapidity, latent demand was formed into actual demand backed at first by bond issues and later by gasoline tax revenues.

What has been done in the highway field can be done in other fields where strong latent demand exists. But if it is to be done rapidly, there must occur a radical change of policy with respect to advertising on the part of many of the largest manufacturers in America.

*H. P. Gillette*

# County and Township Roads

## Rebuilt Earth Roads Surfaced *with Oil at Low Cost*

*Illinois Township Spreads Small Annual Fund*

By F. K. R. ZEIGLER

*Commissioner of Highways, Stonington Township*

THE State of Illinois is known throughout the world for being the leader in many things, probably the one largest thing it is noted for is its wonderful system of hard roads. While these roads take care of much travel and are very heavily used the county and township roads are really the farm to market roads of this state and should be given consideration as such. However, the state system is the main road system and the other roads all feed to it with their travel. Some parts of the state have more mileage of the hard surfaced type than others and therefore are not bothered with the problem of trying to build roads to last throughout the year using an outlay of only \$200

*Above—Oiled road which stood winter months well. Few places are breaking out on this seven-months-old road*

to \$400 per mile. The travel on such roads are mostly heavily loaded farm wagons with narrow tires that do most of their hauling in the spring and early fall when the soil condition is not always at its best.

Located almost in the heart of the Illinois Cornbelt, Stonington Township, Christian County, is fortunate in having fairly level land, but of a black, very mucky, soil condition. Although our land is fairly well drained, it is very hard to make a road stand up under all kinds of travel throughout the year. Especially is this true in the late winter months of constant freezing and thawing.

The largest part of the mileage of roads comes under the care of the townships. Christian Coun-



ty pays toward the upkeep of the state-aid roads; the amount just about pays the cost of maintaining of same.

Each township of this county receives from \$3,000 to \$20,000 of "road and bridge" tax money each year. The townships having the largest towns receive the largest amounts. Also, in most townships, a like amount is usually levied for oiled road purposes on specially designated roads. This mileage of oiled road varies from 20 to 40, although some of the larger townships oil their entire mileage by using part of their road and bridge tax money for this purpose.

After about four or five years of oiling these same roads, over

*Below.—View of township road on February 3, 1931, which had been graded the last week of August, 1930, prior to an application of ½ gal. of E3 oil per sq. yd.*



and over, they become rutty and full of holes. In places where too much oil was used the road will be a mass of waves. The usual thing that is done to remedy these poor conditions is to take the grader and try to cover up these holes and waves. It is a rather poor method to use in this part of the state on an oiled road. I firmly believe that it should not be done any place else if results are to be expected from your labors. And what road man does not want to do the best possible job that his equipment and knowledge of the nature of the work afford? Some commissioners lack equipment to do justice to some of the work needed, there is no doubt of that. But to do the work that I am



about to describe in some detail does not call for anything in the way of equipment that most townships do not already own or can rent from one that does own same.

Stonington Township, for seven years, has been rebuilding its oiled earth roads by scarifying. Some people are rather afraid to tear up their roads for fear that they will ruin same, but this need not be the case, as we have had no failures to date, and as I mentioned before, we have a heavy, black, mucky soil.

The question as to when and how deep to scarify an oiled road, how much to work it, how much oil to apply, and when to do it, can only be answered by experience. The type of soil and the depth of the oil crust are very important items to consider in this respect. Scarifying is the first operation and for this purpose we use a No. 12 Adams grader, substituting a block with 9 teeth for the blade assembly. These teeth should protrude about 8 or 9 inches below the block proper. The power used for this machine should develop at least 40 hp. on the draw-bar; more will not hurt. Fewer teeth should be used with less power. The use of less power slows up operations, which is undesirable, as explained later.

The teeth are put in the ground until the bottom of the oil mat has been reached, usually 4 to 6 inches, working a width as wide as the traveled road, usually 16 to 20 ft. Two rounds are made with the rig in



Road being graded before treating with oil. Soil is not of loose loamy nature

order that all of the top earth be thoroughly loosened. After the first round has been made a crawler tractor (30 hp.) going in high speed is put to work pulling a tandem disc which further breaks up the surface.

As the scarifier finishes its second round another Caterpillar "30" follows pulling a 12-ton roller, the disc and roller each keeping within the scarifier width. The roller makes one time over from edge to edge, after which the surface is again disced.

When this operation has been completed an Adams multiple blade maintainer is used to draw in the dirt that has been unintentionally cast onto the shoulders by the disc. The maintainer moves the dirt toward the center of the road, planeing the high spots and making a crown. In some cases we do what I term "split the middle," i. e., we make a full round throwing the dirt both ways from the crown, then we make an additional round to draw in just the right amount to put on the proper crown. This operation is always the last one. This blading is followed by the roller to make sure the surface is thoroughly packed. Several bladings may be necessary to get the road in the best of condition if the soil has torn up in a tough condition, but usually three times over puts it in excellent condition and nothing more can be done until traffic has had an oppor-

tunity to further compact the surface. After a day or two the maintainer is used to make several rounds, filling in little holes that appear.

A period of from four days to a week is usually time enough in which to bring the road into condition to oil. The oiling should be done just as soon as the road is solid and before any dust forms on the surface. A rain on the work will also be very good for it. The rain provides an excellent chance to find the low spots, if any, and also assures that there will be no dust at oiling time besides further settling the soil. The quantity of oil to apply is determined by the oil mat that was on the surface before it was scarified. For a road carrying an average amount of traffic and is being rebuilt on account of roughness, if the road has been well oiled heretofore, a half gallon to the square yard is about the right amount of oil to apply. This is put on in two applications and should be enough to last for 90 to 100 days, when a final or seal coat is applied. If the road goes through the dry summer months without dusting but is very near that point, then a third coat of, say a quart and a pint (.37 gal.) to the yard should be applied. On the other hand if the road is in a soft spongy condition, at the end of the summer, it is evident that too much oil was used. Then by all means, merely dampen the road surface with the third application of oil. Although this may seem like a waste of oil to some, it will go a long way toward keeping



Home made 12-ton roller used to compact graded road. Built at the cost of \$175. Iron frame now replaces wooden one shown

the mat pliable and in good condition for the winter and spring months.

If applied oil has not been soaked up after 24 hours enough dirt can be brought in from the shoulders to blot up the surplus.

All of our oil is preheated and is applied with a truck distributor of 600 to 1,000 gallons capacity. Where the quantity of oil used annually justifies the cost of truck ownership, the townships own the trucks to apply the oil, otherwise the spreading of the oil is let by contract to contractors equipped for such work.

In 1930 road oil sold for around 4.3 cents a gallon and the cost of applying averaged about 1 cent a gallon. By using from 6,000 to 8,000 gallons per mile our costs were from \$300 to \$425 per mile, the difference in cost varies with the road width. Sixteen feet is the standard road width used in oiling most country market roads, unless an unusual amount of traffic is to be handled; then they are of course of an increased width.

The acceptance of oils from the refineries according to grade is based mostly on viscosity by state specifications of Illinois. We have all of our oil tested as it gives us a guide as to how much to apply. A higher



viscosity rating calls for more heat and a more porous soil. E2 oil tests 9-18 points, E3 tests 18-28; and E4 tests 28-42 points viscosity at 140 degrees Fahrenheit.

If the road builder is to get the best results from his labors in the above mentioned operations of scarifying, he must work his roads when the ground is in the right condition. By using too small a scarifier or too little power the work will be slowed up to such an extent that the dirt will lose much of its moisture. Soil in a dried condition does not work or pack in the manner that is preferred to make a perfect road, which is always the aim of most road men. There are several tools that should be owned or be at hand by every one that rebuilds roads by the above methods. Among them are the multiple blade maintainer and the roller. There are any number of block scarifiers and combination machines that can be had. A heavy road disc has been successful in use. These latter are all special machines and call for a large expenditure of money and are not within the reach of most townships or road districts. They can be used only a short season. By using a grader with the attachments the machine can be



Scarifying a road in Stonington Township. First round is being completed. Next step is to regrade, then roll before applying oil

switched from one job to another with only a small amount of time wasted and the investment in machinery is small. More time can then be put in on the roads that actually need the expenditure of the road funds, the purpose for which they were levied.

If speed is had in every operation of planing, pulverizing, and rolling with a heavy roller then any one should be successful in building smooth, serviceable, year 'round roads from old worn out, rutty roads that are fast becoming nothing but a series of bumps and chuck holes. This applies especially to oiled roads.

Scarifying can be done at any time throughout the summer or early fall months with safety. We have done the work the last of August and first part of September and have had excellent results in the fall months. I really prefer the late summer to the hot weather of late June or early July. If any heavy travel is foreseen before the oil is applied the oiling should be put off until that is over, or, at the most, only just enough oil should be applied to bind the top until the heavy travel is over.



Close-up of the scarifier block in action. To thoroughly tear up the mat the teeth dig in for six inches

## County Commissioners and Engineers of Washington to Convene

County officials interested in road and bridge construction and maintenance will participate in the 25th annual convention of the Washington State Association of County Commissioners and the 26th annual convention of the Washington State Association of County Engineers, to be held jointly at Spokane, Sept. 24, 25 and 26.

Tentative programs released last week to *Pacific Builder*, from which this article was taken, by Alvin H. Collin, Spokane, and J. C. Stegner, Pend Oreille, respectively, secretary-treasurer for the two organizations, include the names of many officials and engineers well known in road and bridge work in Washington. There also appear names of prominent state leaders familiar with the problems of county government.

The convention's sessions will be held in the Davenport Hotel, one of the finest hostleries in the Far West. As in past years, the first day of the three-day convention will be devoted to a joint session of the two organizations. A joint banquet will be held on the second night.

Speakers at the joint session include:

Governor Roland H. Hartley, Lieut.-Gov. John A. Gellatly, Dr. E. O. Holland, President of W. S. C., Fred D. Chestnut, Division of Municipal Corporations for the State of Washington, J. W. Hamilton, Washington State Maintenance Engineer, and Homer Had-

ley, structural engineer for the Portland Cement Association.

Senator C. C. Dill will speak at the convention banquet.

Samuel J. Humes, Director of the Washington State Department of Highways, will speak at the commissioners' closing session.

Strong programs have been arranged for the separate sessions of the two associations on the second and third days of the convention.

The program is tentatively announced as follows, subject to revision:

### FIRST DAY

Thursday, September 24

#### Joint Session—Forenoon

9:00 a.m.—Registration of delegates and guests (ticket of coupons covering luncheon, banquet, and various entertainment features, issued to each delegate and guest).

10:00 a.m.—Joint session of the Washington State Association of County Commissioners and the Washington State Association of County Engineers. Don H. Evans, president Washington State Association of County Commissioners, presiding.

Invocation, Rev. Samuel J. Chaney, St. Paul's Methodist Church, Spokane.

Address of welcome—Mayor Leonard Funk, Spokane.

Response for County Commissioners—President Don H. Evans, King.

Response for County Engineers—Charles Deako, Clark.

10:40 a. m.—Address—Governor Roland H. Hartley.

11:00 a. m.—Address—John A. Gellatly, Lieutenant-Governor.

11:15 a. m.—“Concrete Bridge Design”—Homer Hadley, Structural Engineer, Portland Cement Association.

Appointment of committees and announcements.

12:00 m.—Joint luncheon with the Kiwanis Club of Spokane at the Davenport.

#### County Commissioners' Session

1:30 p. m.—“When Do We Turn the Corner?”—Dr. E. O. Holland, president State College of Washington.

2:15 p. m.—“Road Oiling”—J. W. Hamilton, Maintenance Engineer, Washington State Department of Highways.

3:30 p. m.—“Laws of 1931 Pertaining to County Government”—Fred D. Chesnut, Division of Municipal Corporations, State of Washington.

#### County Engineers' Session

1:30 p. m.—“Relations of Contractor and Engineer”—By a Contracting Engineer (H. A. Sewell, Manager, Interstate Construction and Engineering Co., Newport, Wash.).

2:00 p. m.—“County Planning”—Thomas D. Hunt, King County Engineer.

2:15 p. m.—“County Bridges”—J. B. Garnett, Spokane City Bridge Engineer.

2:30 p. m.—Appointment of Committees. Announcements.

#### Joint Sight Seeing Trip

3:00 p. m.—Complimentary trip to Delegates and Guests to Spokane County Sanatorium at Edgcliff and to the Spokane County Infirmary at Spangle.

#### Evening

Spent in Entertainment.

### SECOND DAY

Friday, September 25

#### Commissioners' Forenoon Session

President Don H. Evans presiding.

9:00 a. m.—Roll Call by Counties.

President's Annual Message—Mr. Don H. Evans, King.

Reading of the Minutes of the Last Session.

10:00 a. m.—“Railroad and Franchise Taxes”—A. O. Colburn, Deputy County Prosecuting Attorney, Spokane.

10:45 a. m.—Discussion — “Tax Relief” — Led by George H. Umbaugh, Cowlitz County.

11:00 a. m.—Open Discussion.

#### Engineers' Forenoon Session

President E. R. Smith presiding.

9:00 a. m.—Roll Call by Counties.

President's Annual Message—Mr. E. B. Smith, Walla Walla.

Reading of the Minutes of the Last Session.

10:00 a. m.—“Use of Timber in Engineer Projects”—By a representative of Weyerhaeuser Timber Co., Tacoma.

10:20 a. m.—“Oiled Roads”—By a representative of Standard Oil Co.

10:40 a. m.—“Concrete Bridges”—By Homer Hadley, Structural Engineer, Portland Cement Association.

11:00 a. m.—Discussion.

#### Commissioners' Afternoon Session

1:30 p. m.—“County Relief Work and the Unemployment Problem”—General James E. Drain.

2:15 p. m.—General Discussion — “County Relief Work”—Led by Alvin H. Collin, Spokane County.

3:00 p. m.—“Indian Lands”—Edward H. Flannigan, Yakima County.

3:15 p. m.—“Road Construction”—Ray B. Woolf, Clark County.

3:30 p. m.—Discussion—“County Problems.”

#### Engineers' Afternoon Session

1:30 p. m.—“Corrugations in Highways”—H. J. Dana, Assistant Director of Engineering Experiment Station, W. S. C.

2:00 p. m.—“Standards and Service Requirements of Forest Development Roads”—F. E. Thieme, Regional Engineer, U. S. F. S., Missoula, Mont.

2:30 p. m.—“Permanent and Lateral Highways”—L. V. Murrow, District Engineer, Washington State Dept. of Highways.

3:00 p. m.—Discussion.

#### Joint Evening Session

Marie Antoinette Room—Davenport Hotel

6:00 p. m.—Annual Banquet for the members of the two associations and their wives.

7:30 p. m.—Address—By the Honorable C. C. Dill, United States Senator from Washington.

Entertainment followed by dancing.

### THIRD DAY

Saturday, September 26

#### Commissioners' Forenoon Session

9:00 a. m.—Reports of Committees.

10:00 a. m.—Address—By Hon. Samuel J. Humes, Director, Washington State Department of Highways.

Election of Officers.

Announcements.

Adjournment.

#### Engineers' Forenoon Session

9:00 a. m.—Open Forum.

Inventory—Led by O. E. Brashears, Yakima County Engineer.

Registration Law—Led by Roy Greene, Lewis County Engineer.

Appointive Engineers.

Any other subjects which may be brought up.

Reports of Committees.

Election of Officers.

Announcements.

Adjournment.

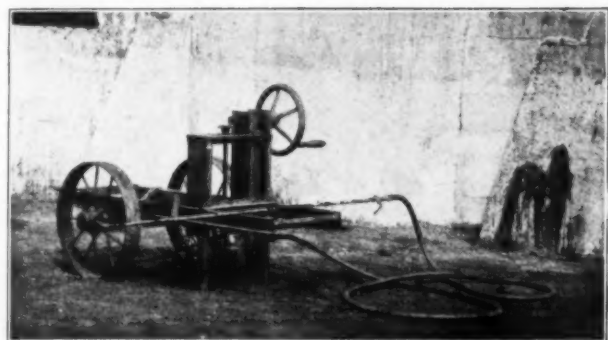
### Across Illinois Prairies



A Gravel Road in Sangamon County, Ill.

# STEPS IN LOADING DRUM *of Emulsion or Bituminous Material*

## *on a Spray Unit for Portable Use with Cold Applica- tion Materials*

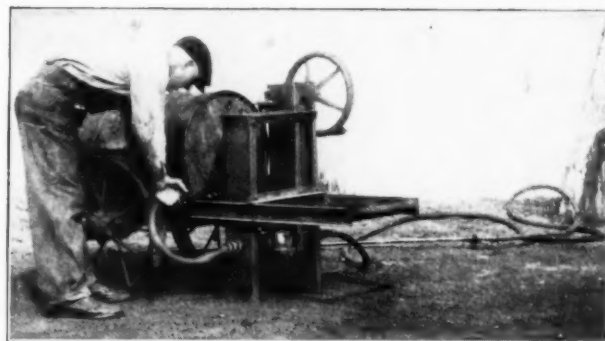


Step No. 1—Set up as shown above

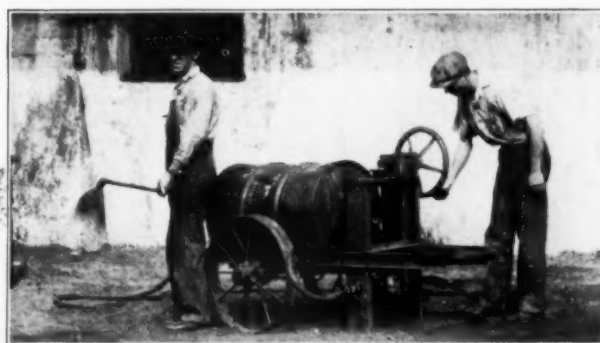
Step No. 2—When the drum is in an upright position as shown below, remove the bung in the head and replace it with the special fitting that is furnished with the spray outfit. This fitting has a syphon tube, self-cleaning strainer and shut-off valve



Step No. 3—As shown below the drum is tilted back enough to allow loading lip of truck to pass under it. Be sure that fitting on drum is toward the truck. Drum is then dropped on to cradle and truck is lowered. The operation is much the same as loading an ordinary hand truck



Step No. 4—The suction hose to the pump is now connected to the special fitting on the drum. The shut-off valve is opened and the outfit is ready for operation. Before starting operation be sure to remove the small air-hole plug in the drum head. This is done only in the case of gear pump outfits to prevent the formation of a vacuum in the drum



Step No. 5—By turning the hand wheel an operating pressure of about 10 lb. is obtained and can be easily maintained by the man at the hand wheel. The unit is ready to spray whatever work is at hand. In every case, the original shipping drum is used without changing the emulsion to any other tank



# BEFORE



This open ditch hazard to motorists in Butler County, north of Middletown, Ohio, was



This fair weather road carried considerable traffic in Middlesex County, New Jersey, that

# AFTER



Decidedly improved by filling over a corrugated culvert that carried the entire stream



Plowed through the mud until this penetration macadam improvement was built

# The Road Builders' News

## New Features for Detroit Road Show

The coming 29th annual convention and road show in Detroit, January 11-15, 1932 has more attractive features from the standpoint of the exhibitor than any previous exhibition.

To the roadbuilder who has not attended a convention and road show of the American Road Builders' Association there are many delights and much information in store for him. Immense halls filled with the latest products of road equipment and material manufacturers present a spectacle that long will be remembered. The mass of people moving in and out of the various display booths in the quest for information, the clamor of operating machines demonstrated for their benefit, the old friends found with joyful greetings, the new acquaintances and friends made—all these are features of every road show and convention. The entire industry of manufacturing and distributing road machinery, equipment and materials is represented at this event. All road builders attend.

To keep in touch with the latest developments in road machinery, equipment and materials, it is necessary to visit the annual road show. The opportunities offered for the inspection and comparison of equipment are eagerly grasped by 25,000 road builders each year.

One of the attractive features of the Detroit road show is that the problem of floor leads is solved by the fact that the 230,000 square feet capacity of the



Detroit exhibit building, 1,000 feet long, is all on the ground floor. The Municipal Airport building which will be used has enormous doors permitting the easy entry without dismantling of the largest equipment such as a crane or steam shovel. The lighting and heating facilities are ample and modern. Restaurants will be in the building.

**Comfort of Visitors Assured.**—Another attractive feature of the Detroit event will be the new plan of housing roadbuilders attending in such a way that they can be easily located in the various hotels. Headquarters will be established and delegates quartered in mutual-interest groups in different hotels. For example, county officials will be in one hotel, city officials in another hotel, and similarly for the various groups.

Before people can visit an exposition and attend convention meetings it is

necessary to get them comfortably and economically to Detroit and provide satisfactory hotel accommodations. Transportation is in charge of an experienced passenger traffic official who is assigned to the association by one of the larger railroad companies. Special trains and special cars are arranged for, special rates for the event established, excursion plans made from nearby territory, agents of all railroads notified, motor car transportation stimulated, and a multitude of plans prepared. A special railroad ticket office is set up in the exhibit hall for the convenience of delegates.

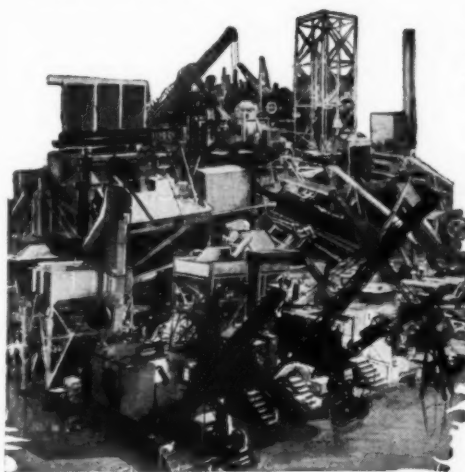
The housing committee, established for convenience in the convention and road show city, handles hotel reservations. Special forms are sent in advance by the association amounting to 40,000 mailing pieces. These forms give special hotel rates established by agreement with association officials and permit the visitor to make his own hotel selection. If he has no preference, rooms are assigned by the housing committee. The hotel accommodation in Detroit is splendid.

To let road builders know about the type of exhibits and convention discussions, over a million mailing pieces are sent out from the Washington headquarters in the few months just preceding the event.

**Organizing the Road Show.**—There are many problems to be solved in setting up this largest exposition of machinery, equipment and materials held in the United States. At the last road show, in St. Louis, it was neces-







sary to handle 12,000,000 pounds of car-load freight, 440,000 pounds of express, and 1,500,000 pounds of local and drive-in exhibits, a total of 13,940,000 pounds. There were 320 freight cars to be unloaded, and equipment and machinery placed in the exhibit halls using both contract and its own power. Police and watchman service had to be arranged. Electrical connections, gas, rails, signs and furniture had to be supplied for 323 booths ranging in size from 100 to 3,500 square feet in area. All this work had to be done in six days. Moving out was done in about the same time.

**What Goes on Behind the Scenes.**—Only by efficient organization and co-operation can this task be accomplished successfully. Experienced moving contractors are employed. The association requires that the moving contractor each year shall have visited and studied the setting up and dismantling of a previous exhibition. Magnificent cooperation has always been extended by different convention hall managers and this has aided materially in the success of each road show.

The organization of the association for handling the convention and road show is expanded three months before the event. An office is opened in the convention city and details of the exhibit handled from there rather than at the national headquarters in Washington, D. C. A month prior to the meeting the director is on the ground bringing with him permanent staff men and experienced floor managers who have been with him for years and know just what are their duties. Each man goes about his special tasks and at the round table dinner meeting each night reports what has been done in preparation or execution, tells his difficulties, and arranges his next day's work. The director is in touch at all times with every activity.

As the convention date approaches the tempo increases until a few days before the event when both night and day work begin. A regular order in placing equipment is followed, dependent on arrival. Intricate problems of juggling must be solved to get mammoth equipment in place without obstructing the moving of other equipment; some single pieces weigh

97,000 pounds and booms are 50 feet long. Exhibitors frequently lend a hand to the moving contractors with cranes, tractors and other power equipment. A spirit of rivalry and good fellowship is found throughout among the exhibitors and workmen. Often a contention for right of way is followed by an exchange of reminiscences of previous shows with a hastily-grabbed hot dog sandwich and cup of steaming java in hand. The setting up moves with clock-like regularity under the direction of the association floor managers and their assistants, in cooperation with the exhibitors.

The several hundred men engaged in setting up the show are through on Saturday morning, Distributors' Day, and the exposition is open to manufacturers and distributors of equipment and materials only. New models are examined by distributors and salesmen who are called in by the various manufacturers with exhibits. Meetings are held, new connections made and the road show is ready for the formal opening on the following Monday.

**Convention and Road Show Attracts 25,000.**—During the five exhibit days other organizations meet that are interested in road building, delegations of state, county and city officials, contractors and foreign government representatives are in attendance to inspect and compare the exhibits. At St. Louis one of the most diversified and largest equipment exhibits ever held was possible because of the combined interest of all who are associated in the highway industry. In addition to the usual exhibits, Detroit will have an extraordinary large motor freight exhibit.

The annual convention is the culmination of the activities of committees and staff engineers of the association who are engaged in research and investigative work throughout the year. Subjects for research are carefully selected and information is assembled for committees by staff engineers of the association. The research activities have come to be recognized through the highway industry among state, county and city highway officials, contractors, manufacturers, distributors and motor freight operators as of particular usefulness. The aim of this work is to translate into most usable form and popularize the facts discovered not only by the American Road Builders' Association, but by all other highway research agencies in this country and abroad. The Proceedings of the association are used as text books in a number of technical schools.

### **Highway Bonds Now Desirable**

Bonding for state highway construction has been a paying investment in every instance, according to a report of the American Road Builders' Association. Tangible savings from lowered cost of operation are in excess of



construction and maintenance costs in all cases.

The savings in operating costs to motorists of Illinois are estimated to be \$333,000,000 since the improved highway program was started which is considerably more than the first cost, interest and amortization charges on the \$160,000,000 highway bond issue.

Bonding is generally recommended, the report states, for both states and counties where credit is sound, where there is an urgent need for highways, and where there is a fixed annual income. The issuing of bonds should be preceded by economic studies of credit conditions of the political subdivision, industrial growth, agricultural needs, population trends, transportation demands, and the availability of road building materials.

### **Highway Traffic Devices Must Be Standardized**

There is practically no uniformity in the design, construction or use of traffic devices states a report of the American Road Builders' Association.

One manufacturer reports as to standard STOP signs that production for stock is impossible because each order he receives has variations. He is called upon to furnish 27 different secondary copies, three sizes of one secondary copy, three sizes of signs four different gauges of metal, three different color combinations, five variations in finish and fabrication, six requirements as to the number of reflector buttons, three different colors of buttons.

Many of these variations tend to confuse the mind of the motorist; all of them add materially to the cost of production and maintenance. Much study is needed to bring about proper standardization.

### **Highway Financing Is Profitable Now**

Expenditures on highways are profitable now because of the needs of the unemployed and the low cost of accomplishing needed road and street improvements, according to W. R. Smith, president of the American Road Builders' Association.

"Road building readily absorbs men engaged in all industries that are temporarily inactive. No special training is required for common labor on

the roads and streets and, therefore, highway building is an ideal public work for the relief of unemployment. A man who is given a job does not lose his self-respect like one who is forced to accept charity.

"The recent statement of a representative of the American Society of Automotive Engineers that within a decade road speeds of 100 miles an hour are to be expected gives an idea of the additional burdens that are continually being placed on the highways. We may expect under such speed conditions express highways with marginal roads for slow traffic, much elimination of both highway and railroad grade crossings, and the relocation and widening of many highways to fit them to handle high speed traffic. The formula for highways, safe drivers plus safe vehicles plus safe roads equals safety, states the three elements that must be considered.

"Roads for the public can be built now at a much lower cost than in past years and it is highly improbable that the present conditions of depressed prices will continue indefinitely. The public can buy roads and streets now to advantage.

"The expansion of the highway program needed to bring roads and street facilities up to the standard of motor vehicle improvement will do much to stimulate business," he concluded.

### **Gasoline Tax Diversion Must Be Stopped**

Efforts to divert the gasoline taxes and motor vehicle license fees from legitimate uses in the improvement of highways for the benefit of motor vehicle owners have aroused motorists to action.

Attempts were made this year when 42 legislatures were in session to divert tax money to illegitimate state uses. Happily, the public demand for road building to employ labor on the highways together with the demands of traffic for more comfortable roads for vehicles traveling at high rates of speed prevented any material diversion. Next year only a few legislatures will meet, but in 1933 the 42 legislatures will again convene.

A number of states have diverted the gasoline tax and the motor vehicle fees but the total is less than 3½ per cent of the total amount collected according to a recent statement of the American Road Builders' Association. Money has been used for all kinds of things not related to roads. Kentucky is buying Mammoth Cave with gasoline tax money. Maryland supports a conservation department busy with oyster propagation. Michigan thinks her conservation commission should be supported by motorists; Florida, Georgia and Texas diverted in 1930 a total of \$13,404,200 to the support of schools—the largest single item of diversion—motorized education; Mississippi built a sea wall. New York City receives 5 per cent of the state gasoline tax fund to replenish the general city fund of many uses. Idaho and Michigan build aviation fields but they collect taxes on gasoline used for aviation which partly covers the diversion. Louisiana is building a city harbor with \$155,000 of the gasoline tax money in 1931. A total of

about 3½ per cent is now diverted from the motor vehicle income.

Besides these direct diversions from roads in seventeen states, other hidden diversions exist. In many cases, the money returned to counties by states from the gasoline and motor vehicle taxes goes into the general fund and is used for the poor farm and other purposes that doubtless are worthy but do not make the roads any better.

The principle of the gasoline tax is that of a special tax in lieu of toll for the use of the highways. The reason the tax has been so popular in the past is that the money has been spent for the benefit of those that pay the tax.

Motorists are interested in roads and some are already seeking to have the motor vehicle taxes reduced when the proceeds are not put back into the roads. There are 26,000,000 motor vehicle owners. Some legislatures are "killing the goose that laid the golden egg" that has done so much to stabilize road building.

### **Motorists and the Road Show**

The world's largest exposition of road machinery and materials—14 million pounds of it—will be held in Detroit in January, 1932, and many motorists will want to attend this exposition according to officers of the American Road Builders' Association.

Along with this exposition will be the 29th annual convention of the American Road Builders' Association at which reports on road building, maintenance, financing and traffic will be presented by several hundred road building authorities and discussed by the 25,000 assembled at this annual exposition and road show.

Motorists will be interested in the discussions of motor freight, the diversion of the gasoline tax and motor vehicle fees for purposes other than highway building, the planning of city traffic regulations so that congestion will be reduced and many other matters of vital interest to motor vehicle owners.

It is significant that Detroit, grown to be the world's center of production for motor transportation vehicles, should entertain again the world's largest event for the development of highways that provide a place for motor vehicles to operate. The American Road Builders' Association, which is engaged in developing highways and effecting economies in road and street building, was organized in Detroit in 1902 and has grown to be a tremendous power in highway activities.

### **Statistics of Cities and Counties Collected**

Detailed statistics of 150 cities and 200 counties have been collected by the City and County Divisions of the American Road Builders' Association.

These figures give complete information about programs of construction, the personnel of the various departments having to do with county roads and city streets, and other pertinent facts.

The county highway figures also show the total mileage of highways

and the state of improvement, bonds outstanding, county highway expenditures, and the expenditures for road equipment together with the name of the man ordering such equipment.

The city street figures show the square yards of existing pavements, street expenditures for various years, square yardage by types of pavements during the past year, city expenditures for street equipment by classes, and legislative policies enacted or anticipated for the different purposes.

Association officials hope that with the increments of new information added each year to these statistical data there will be built up a complete picture of city and county conditions that will be of unusual value.

### **20 Ft. Highways Minimum Recommended by Road Builders**

Road widening to a minimum of 20 ft. is recommended in states and counties in a committee report of the American Road Builders' Association by C. E. Burleson, county highway engineer, Clearwater, Fla., chairman of the committee on road widening. Recommendations are also made as to when and how roads should be widened.

Future traffic demands as to width of pavement should be anticipated for ten years, the committee says, and right of way should be wide enough for conditions 25 years hence. Highways for two lanes of traffic should be paved at least 20 ft. wide and 6-ft. shoulders for parking. Intersections should be widened to four traffic lanes (40 ft.) for 300 ft. in each direction from the corner. Where traffic exceeds 4,000 vehicles a 10-hour day, or frequent peak loads in excess of 800 vehicles an hour in one direction exists, a three or four lane road is needed. The salvage value of the old pavement should be sacrificed to improve the alignment or to provide clearer vision over hills.

In widening an old pavement, a narrow but substantial widening strip even with the old surface on both sides improves the appearance of the road, gives definite limits for pavement maintenance, and guides traffic. A few feet added to one side is less expensive than widening both sides, but the new track of vehicles may change the heavy loads to a weak point on the pavement.

Pavements on curves, comments the committee, should be given from 1 to 6 ft. extra width, and they should be marked down the center to separate traffic.

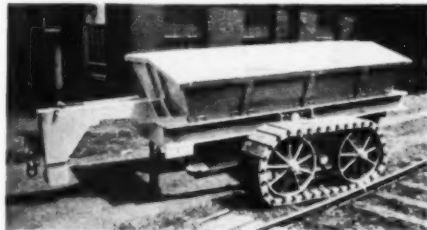
"Based on facts collected from numerous states and counties, the committee lays down rules for road widening which, while not ironclad, give a consensus of engineering opinion as to when and how the work should be done," stated Chas. Grubb, engineering executive in charge of fact collection.



# New Equipment and Materials

## New Crawler Wagon Announced

Davenport Road Machinery Co., Davenport, Iowa, are offering a five and seven-yard wagon equipped with their new crawler type tracks and hydraulic operated doors. They are using an extra heavy 17-in. shoe on their tracks, and these crawler treads are equipped with an



*New Mid-West Crawler Wagon*

extra heavy set of bearings throughout. The body of the wagon is welded throughout, and the hydraulic wind-up mechanism is enclosed in the tongue, so as not to be damaged by rocks and dirt when working in bad conditions.

The crawler treads are so constructed that they will pull easy and give long life.

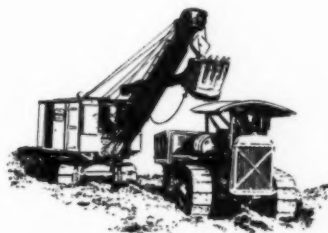
They are offering this wagon to the trade at a very reasonable figure. There are no links or other parts on the tread to cause any obstruction when working in rock and other difficult places.

This new wagon is called the Mid-West Wagon. Complete information may be obtained from the Davenport Road Machinery Company, 1730 Rockingham Road, Davenport, Iowa.

## Sauerman Scraper Turns Corner

Ordinarily the path of a power drag scraper is a straight line from the digging or loading point to the dumping point. There are, however, situations that require the scraper to turn a corner somewhere along its span and work along two paths at approximately right angles to one another, and with a patented "dog-leg" device recently developed by Sauerman Bros., Inc., 428 South Clinton St., Chicago, an operation of this sort is entirely feasible.

Where the customary drag scraper installation consists of a two-drum hoist, two operating cables for inhauling and outhauling the scraper bucket, and two guide-block supports (one at each end of the span), the "dog-leg" installation consists of a three-drum hoist, three operating cables, and three guide-block supports. The third block support is of course at the point where the scraper makes its right-angle turn, and the third operating cable is a "center-haul" cable which serves always to pull the bucket toward the turning point (on both the inhaul and the backhaul). This center-haul cable passes over a guide-block at the turning point to a rod connecting the front and rear bridle of the scraper, so that it pulls on the front bridle during the inhaul but slides to the back of the bucket to pull on the rear bridle during the backhaul. The reg-



ular load-line pulls the loaded scraper from the turning point to the dumping point, and the regular pullback cable returns the empty bucket from the turning point to the digging point.

Some of the situations that make an installation of this sort desirable are (1) digging or reclaiming from storage parallel to tracks and turning a corner to mount a car-loading incline; (2) excavating in a basement or reclaiming from a storage room where columns make it impossible to work radially from the hopper or dump; (3) in underground mines, loading cars in a corridor at right angles to the working face; (4) digging lengthwise in trenches and turning to drag the spoil onto the bank. It is also possible to use this device with two tractors, one with a double-drum and the other with a single-drum hoist, instead of the regular three-drum scraper hoist; or, to equip



*Sauerman Drag Scraper with "Dog-Leg" Device*

the second tractor also with a two-drum hoist and use the extra drum for operating a rapid-shifting device.

In the accompanying illustration, a 1½-yd. scraper reclaims mine waste from a pile under a track hopper, turns a right angle and drags the spoil out to a dump parallel with the tracks.

## Improved Portable Cement Pump

Fuller-Kinyon improved portable pumping systems are particularly designed to unload bulk cement from standard box cars, deep-draft and houseboat type cement barges. They are available in a full range of capacities, suitable to meet the requirements of all commercial mixers and adaptable to highway, construction, central mixing and concrete products plants.

Systems are usually arranged to deliver directly from cars or boats to mixer or storage bins. One of the outstanding advantages of this portable equipment is the possibility of eliminating expensive overhead storage bins or silos, as simple, flat-

bottomed warehouses of cheap construction form a convenient storage.

Among the characteristics of this equipment are absence of dust nuisance and loss of material; ease of installation and operation and complete portability of the unit and system from one construction job to another.

The perforated disc feeder, rotating at a relatively slow speed, delivers the cement to the barrel of the pump, through



*Type "A" Fuller-Kinyon Portable Cement Pump*

which it is advanced by the impeller screw, driven by a built-in motor. The mounting of this motor is of special design, but the electrical parts are standard.

Beyond the terminal flight of the screw, a small quantity of compressed air is admitted through a number of small ports. This air creates a fluent or artificial flooding condition, so that the cement will be forced through the transport line by the introduction of new material by the screw.

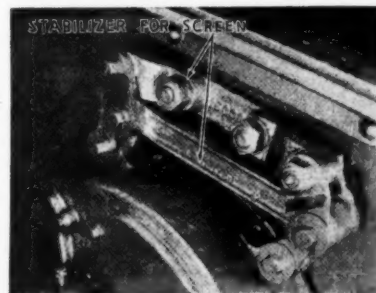
The machine is so constructed that in case of accident, any parts that may be damaged may be replaced by common labor in a few minutes without special tools.

## Simplified Mounting for Stephens-Adamson Vibrator Screens

An interesting new vibrating screen mounting has been developed by Stephens-Adamson Mfg. Co. of Aurora, Ill.

Ordinarily, vibrating screens are balanced upon springs which hold the screen body at the proper screening angle and yet are flexible enough to permit the screen to be given a vibrating motion.

In the new Stephens-Adamson mounting, the balancing springs have been replaced by a single mechanical unit called



*Stephens-Adamson Screen Stabilizer*



a "stabilizer." This is mounted on one side of the screen and while the screen body can vibrate freely with the eccentric drive shaft, it cannot be rocked or bounced by sudden surges of material over the screen.

The unit is light in weight, simple in construction and surprisingly effective. It holds the screen at a definite screening angle and yet offers no resistance to the vibrating action. The screen body can be quickly shifted to a new angle by simply loosening two bolts on one side of the screen.

The stabilizer consists of two pairs of short cast steel arms, each jointed in the middle, and held parallel by a heavy cross bar. One end of each arm pivots on the flywheel housing, which is solidly mounted on the heavy steel subframe. The other end of each arm is free to move in a shackle on the screen body.

### Armco Introduces Metal Cribbing

A booklet describing a new metal cribbing (developed recently by the American Rolling Mill Company) of simple, yet ef-



Open Face Style Armco Metal Cribbing

fective design is being offered by the Armco Culvert Mfrs. Association, Middletown, Ohio. The new cribbing is adaptable to use for railroad and highway retaining walls, bridge wing walls and river and harbor bank protection work.

Drawings and photographs show how the cribbing is installed and how both the open and closed-face types look when in place. A copy will be sent on request.

### New Floor Grating

The Central Iron and Steel Company of Harrisburg, Pa., announces that the company has developed and placed on the market an improvement over the ordinary fabricated floor grating. They have designated it their "Slotted Floor Plate."

Central's new Slotted Floor Plate is non-skid and proof against slipping in any direction. Because of its basic design, it requires no deep recess or rabbet in which to set.

These slotted floor plates can be furnished in almost any gauge and size up to 72 in. by 240 in. An expensive supporting structure is not required with the Central Slotted Floor Plate.

In addition to being non-skid, this new

slotted floor plate has other desirable characteristics. It allows free ventilation, free drainage, passage of light and reduced weight. One or more of these qualities obviously recommends its use for fire escapes and exterior platforms; flooring and galleries in industrial plants where trapped fumes, gases or heat may produce a hazard; walkways around presses where light is valuable; and any other place where gratings have heretofore been used.

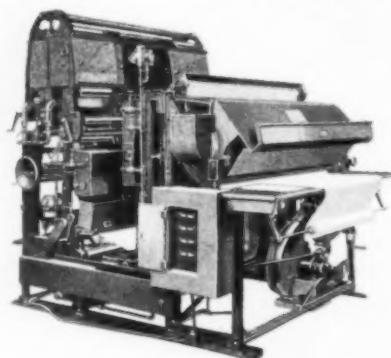
### Continuous Blue-Printing Equipment Developed by Pease

The new Pease "Peerless" Model "25" continuous blue-printing equipment is intermediately priced between the Pease "Peerless" Model "30" and Model "20" blue-printing machines and combines many of the outstanding features of both. Model "25" was particularly designed to meet both the demands of the moderate budget for blue-printing equipment and the requirements for high quality prints at the same time.

The Model "25" complete equipment is composed of three units: the blue-printing machine, the washing machine, and the potashing, washing, and drying machine.

The blue-printing machine can be operated independently from the washing, potashing, and drying equipment by means of a simple clutch adjustment. All units are made in two sizes, 42 in. and 54 in. wide and the machines can be wired to operate on either 220 volts direct or alternating current. The 42-in. machine is equipped with 6 lamps and the 54-in. machine with 7 lamps.

The dryer of the Model "25" is something entirely new in arrangement. It is a twin-radiator air-type dryer consisting of two banks of heating units between



Pease Model "25" Blue Printing Machine

which the paper travels, around a floating idler roll that can be raised or lowered by means of a crank handle, thus making it easy to thread the paper through the machine.

### New Welding Rod Announced

United States Patent 1,815,464, issued on July 21, 1931, to Frank A. Fahrenwald, Research Engineer for the American Manganese Steel Company, has been assigned the company.

The outstanding features of the Amsco nickel manganese steel welding rod are these:

Welds can be made by relatively unskilled operators. When our rod is melt-

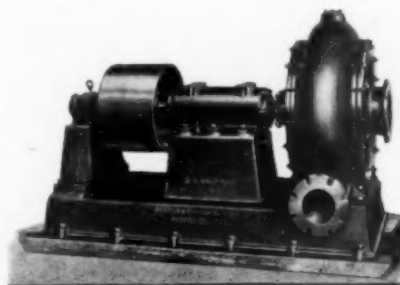
ed in the atmosphere and applied to ferrous metal articles, it exhibits the essential characteristics of standard heat treated manganese steel, namely toughness, ductility, resistance to abrasion and hardening under cold working. The high nickel content (approximately 5 per cent) overcomes any tendency of the metallic manganese content of the rod to oxidize and prevents embrittlement under slow cooling, which the rather high carbon content might cause in the absence of the high nickel content.

The AMSCO manganese steel welding rod is a result of research work done at their Chicago Heights plant, commencing several years ago.

### Amsco Adds Pump

The American Manganese Steel Company, Chicago Heights, Ill., has recently added the new Type "C" to their line of abrasive materials handling pumps. This new pump is of strictly Amsco design, made of Amsco manganese steel and offered the trade at unusually low cost.

Many new features have been included in these pumping units. Bearings are interchangeable in the field; either sleeve



New Type "C" Pump by Amsco

or anti-friction types being available; lubrication is required only on main bearings (except where outboard bearings are used); impeller clearance and main bearings can be adjusted easily without dismantling; thrust and radial shocks are absorbed by new bearing arrangement.

The new Amsco Type "C" pump will meet present day demands for long life, high capacity and low price.

### Sterling Develops Pump Unit

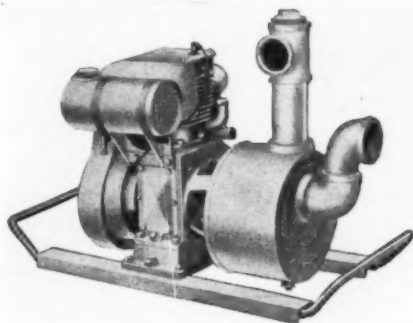
Sterling Machinery Corporation of Kansas City, Mo., announces a new centrifugal pump. Following are some of the characteristics:

Automatic positive priming—suction lifts up to 29 feet. Pumps air or water or a mixture of air and water. Valuable for seepage as pump picks up water as soon as it accumulates. Used for dewatering trenches, foundations, excavations, manholes, pier holes, etc.

Simple positive ejector type vacuum is pump built in; no valves, no pistons, no cams, no chain drives, no floats. Due to the fact that there are no reciprocating parts in vacuum pump to wear out, vacuum pump rotates continuously thus priming centrifugal pump whenever necessary.

Vacuum pump is independent of centrifugal water pump, hence does not affect design of centrifugal water pump.

Sand pump type design with sand pump type impeller and extra heavy semi-steel case or shell with no bearings in contact with water provides for long life and



*Sterling Automatic Centrifugal Pumping Unit*

trouble-free performance when pumping dirty, gritty water.

Crankshaft is mounted in Timken roller bearings and is protected through the pump stuffing box by a renewable bronze shaft sleeve, so that packing cannot cut the shaft.

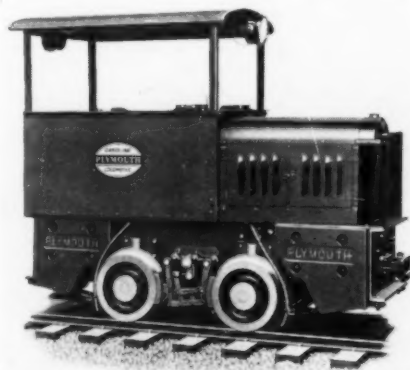
Engine is of the vertical single cylinder air cooled four cycle type, and is of modern design throughout. Engine is complete with carburetor, magneto, adjustable governor, gasoline tank and all accessories, so that the complete unit is ready for operation.

### New Gasoline Locomotive

To meet the requirements of those having a light haulage problem, a new model gasoline locomotive equipped with Ford engine and 4-speed truck transmission has been announced by the Fate-Root-Heath Company (Plymouth Locomotive Works), Plymouth, Ohio.

Built in four weights, 2½, 3, 3½ and 4 tons, on a short wheel base to negotiate sharp curves and with abundant power, it makes an ideal unit for contractors, quarries, sand, gravel, and clay plants and general industrial haulage.

A Plymouth reversing transmission, connected by a shaft and universal joints to the Ford 4-speed truck transmission,



*Fate-Root-Heath Gasoline Light Locomotive*

provides four speeds in either direction.

The side frames, bumpers and cross supports are of heavy structural and bar steel, well braced and rigidly riveted and welded together, making a very strong frame.

The large, roomy cab gives clear vision in all directions.

Standard equipment provides electric starter, generator, headlights, horn and oil-moistened air cleaner.

An illustrated 12 page Bulletin has been

issued giving complete, detailed description.

### Self Propelling Gravel Reduction Plant

A self propelling gravel crushing plant designed particularly for use in small jobs requiring from 500 to 5,000 cu. yd. of gravel is a recent product of the Wisconsin Foundry & Machine Co., 620 East Main St., Madison, Wis.

The power to operate and propel the plant is furnished by a single 75 hp. unit. Control of the plant is accomplished by one man. The whole unit is mounted on a heavy I-beam frame truck, carried on six rubber tired roller bearing wheels. The propelling traction is obtained through four rear drive wheels. For propelling the plant the transmission has six forward speeds and two reverse speeds, high speed being 6 miles per hour and low speed ½ mile per hour.

In operating the plant the power shovel



*Self Propelling Gravel Reduction Plant*

located just ahead of the plant loads the gravel into the receiving hopper located at rear end of truck. A grizzly, arranged at top of the hopper, prevents oversize stones entering hopper and discharges them to rear of truck. The material from the loading hopper is conveyed and discharged onto a set of grizzly bars that allow the fines to pass direct to storage hopper while the larger material passes on to the double deck vibrating screen.

The material that does not pass through upper vibrating screen continues down the incline to the 9x36-in. roller bearing crusher. The material that passes through upper screen but not the lower screen is received by a set of 24-in. by 14-in. crushing rolls. The material that passes through both screens falls into a storage hopper, and is then conveyed to trucks by means of a folding conveyor extending out to one side of the plant. The large stones that passed through the crusher and the smaller stones that dropped into the rolls are crushed and conveyed by means of a belt feeder to an elevator which elevates the material back to the screens for separation and sizing.

The capacity of the plant varies with the nature of the material in the pit. It is stated that an average of 60 cu. yd. per hour of 1 in. stone can easily be produced with pit run material having about 40 per cent fines and 60 per cent of crushing.

### Belmont Flooring

Belmont Iron Works, of Philadelphia, Pa., announce the development of a new type of steel fabricated flooring. It consists of laying series channel beams or I-beams together and riveting or welding

them to form a surface which may be filled with a flooring material. The edges of the beams overlap in order that they may be riveted.

### Hug Announces New Roadbuilder Truck for Quarry Field

A new heavy duty truck known as the Model 99 Hug Roadbuilder and designed especially to meet the extremely severe conditions of operation in the quarry field, is announced by The Hug Co. of Highland, Ill.

This new model truck has a maximum pay load capacity of 30,000 lb. An outstanding and exclusive Hug feature embodied in this truck is the set-back front wheel design which makes possible a short wheelbase and at the same time distributes part of the load over the front axle. Another notable feature of this heavy duty truck is a newly patented device known as the Hug front spring rocker, the purpose of which is to eliminate the undesirable features of conventional front spring suspension in road building trucks.

The new model is powered with a Buda heavy duty 6-cylinder truck engine 4¾x6, developing 126 hp. at 1850 r.p.m. It is equipped with a 4-speed transmission and an auxiliary transmission making possible twelve speeds forward and three reverse, and giving a total reduction in low gear of 139.23 to 1.

Tire equipment consists of Overman heavy duty cushion tires, size 40x16 front and 36x8 rear. Other equipment includes two double reduction rear axles, both driven, and each equipped with air brake.

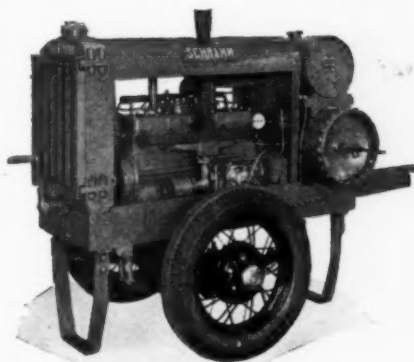
The frame is made of 9-in. I-beam steel and is especially designed and constructed to withstand extreme stress and strain.

The body of the Model 99 Roadbuilder is a 10-yd. specially designed quarry body as furnished by the Easton Car and Construction Co., Easton, Pa. Body bed is built of ¾-in. plate steel and has a reinforced bottom of 3-in. oak sills and ½-in. plate. The oak sills and the ½-in. plate form a false bottom and absorb the shocks caused by the dumping and dropping of heavy sharp rocks and stones.

A Woods W-8 special heavy duty hoist completes the body equipment.

### A New Small Size Compressor

An addition to its line of portable gasoline driven compressors has been announced by Schramm, Inc., West Chester, Pa. This is a 36 cu. ft. unit containing many of the features found in the larger models. It is a heavy duty 6-cylinder outfit, with four power and two air cylinders,



*New Schramm Compressor*



the two cylinders in the center supplying air and the four outside cylinders furnishing the power. The automatic governing features, slowdown device, high tension magneto, carburetor, air filter, water circulating pump, fan, steel housing with removable sliding doors, large single core, or sectional radiator, are the same features used in the larger units. The crankshaft, which is of exceptionally large diameter, has seven main bearings.

Any of the various mountings, including the two wheel trailer equipped with pneumatic tires, can be furnished on this new size. Write Schramm, Inc., West Chester, Pa., for their bulletin 3101 describing the new 36 cu. ft. unit.

### New Twin Disc Clutch

The type of Twin Disc clutch shown in the accompanying illustration was designed for use in small high speed installations where a compact unit (whose operating mechanism is not affected by centrifugal force when disengaged) may be required. The component parts are of the simplest form, and are designed to interlock in such a manner that no cotter pins or similar fastenings are required. The levers are housed within the nut structure similar to the Twin Disc machine tool type clutch and are operated by a cone of internal form. Adjustment is very simple, and consists of screwing or unscrewing an adjusting ring, clamped by a screw having a coin slot. The levers and this screw are of heat treated nickel steel and the clamping plates are ground to insure full contact. The clutch is made in dry plate form, with a single driving plate, which may be bolted to the driving member, driven by round pins, or may have gear teeth cut on the periphery for driving from an internal gear ring.

It is also made for use in oil spray, using 2 bronze discs of lug type, and 1

steel disc; in place of the simple dry plate. The internal cone may be operated by the usual collar having trunnions or by hand wheel if required. Trunnion blocks can also be furnished for use with an operating fork, when the clutch is used in an oil spray.

The Twin Disc Clutch will be used on fractional horsepower motors, power lawn mowers, washing machines, power sprayers, pumps, power planters and other small industrial and agricultural applications.

### Morse Announces Coupling Chain

The Morse Chain Company of Ithaca, N. Y., have developed a new flexible all-steel coupling. The coupling, which is designed for shafts up to 1 in. diameter, consists of two sprockets held together by a chain provided with large pins for maximum strength and ease of coupling and uncoupling. The connecting pin may be removed without the use of tools. After shafts are aligned the coupling chain is connected by use of cotter pins. Lubrication is claimed to be unnecessary.

### Outstanding New Improvements on DW-7 Wagons

We want to call your attention to many important improvements and changes on this hand-wind and hydraulic  $\frac{3}{8}$ -yd. wagon.

Actually, this wagon will now turn at an angle of 102 degrees. It has two hitch points—the lower hole for direct hitch to the tractor, and the upper hole for connecting the second wagon behind the first. The tongue is a box type and is made of special molybdenum steel, which is heat-treated to increase its strength and toughness. The tongue is

then bolted to the long 21-in. deck on the front of the wagon frame, giving not only a secure and solid attachment, but one which, in case of replacement, could be changed very easily and quickly.

The new box type special cast-steel rear frame cross-member and pullbar casting is also securely bolted to the wagon frame with large bolts, to permit quick replacement. Notice that the rear pullbar extends out, which makes it possible to turn at 102 degrees also with the second wagon in train.

The new and simplified hand-winding mechanism is equipped with roller-bearings.

The cable and sheave arrangement on the bottom of the doors and the equalizing sheave permit the cables to follow through in perfect alignment. The cable is in one piece, dead-ending at the rear and running around the equalizing sheave at the front, which makes both doors always pull up equally, and prevents one cable from being a little tighter than the other, due to unequal stretching. The tapered sheaves are so arranged that the cable pulls around them in a manner so that the sheave turns easily, thus preventing the binding which occurs when an improper sheave arrangement is used and the sheaves do not turn.

The new hydraulic hoisting arrangement on the hydraulic wagon is very much simplified and lighter. The wagons which are equipped with this hydraulic hoist, are also equipped with the hand-winding mechanism on the rear, so that in case a customer having one of our hydraulic wagons, wanted to use it with a tractor not equipped with the pump for operating the hydraulic hoist, he could then wind the doors by hand, just the same as the regular hand-wind wagon. Don't overlook this feature, as it is a very important sales talk and answers the question which practically every customer



Twin Disc Clutch for Small Installations



Morse Shaft Coupling Chain



brings up as to how he would wind the doors in case he wanted to use the wagon with a tractor not having the hydraulic pump. In order to dump the hydraulic wagons it is no longer necessary to pull a trip cable to release the doors. The wagons are wound up with a hydraulic hoist and the control lever is then placed on the "hold" position and the load carried on the hydraulic jack. Then in dumping, the man merely pushes the hydraulic control lever to the "lower" position, and the doors open instantly,

Purox welding torches, Types 10 and 20 and Prest-O-Weld welding torch, Type W101.

### Inland Producing Steel Sheet Piling

In broadening the range of Inland products and service to meet more completely the needs of steel users, Inland Steel Company of Chicago announces the addition of Inland steel sheet piling. IA 15-34 and ID 16-25 are the first two

10 are furnished as standard equipment.

The Purox No. 21 cutting attachment designed for use with the Purox No. 11 welding torch will cut metal up to 2 in. in thickness. It is furnished with one and two piece Purox cutting tips. By means of this cutting attachment the welding torch can be easily and quickly converted into a cutting torch. This is the lightest cutting attachment on the market, weighing only 1 lb. 8 oz.

An adaptor is also available which makes it possible to use the Purox No.



La Plant-Choate "Roadlayer" Wagon

or they can be lowered gradually, to permit spreading in loose materials.

### Milburn Develops Adapter

The Alexander Milburn Company, 1416-1428 West Baltimore Street, Baltimore, Maryland, manufacturers of oxy-acetylene apparatus, paint spray equipment and portable carbide lights, announce an entirely new cutting and welding torch known as the Milburn Type RIF-A.

This torch is rugged and durable in construction. The principal parts are of forged bronze and the tubes nickel silver, assuring greater strength, rigidity and long life. It has a patented, leak proof, high pressure valve which is readily accessible and the seats may be renewed without disassembling handle or other parts.

An outstanding feature of this torch is that the head is designed to take conical seated tips Nos. 1RIF to 8RIF, which will also fit Purox Type E cutting torch.

sections of the line. Other sections to complete the line will be added in the near future. The accompanying illustration shows the Inland sheet piling sections now produced. In addition to the strength and driving qualities of the piling, the Inland sections are featured by a particularly strong interlock.

Section	IA 15-34	ID 16-25
Weight per foot.....	42.50 lb.	33.32 lb.
Moment of inertia.....	19.10 in. <sup>4</sup>	49.60 in. <sup>4</sup>
Section modulus per single section .....	8.42 in. <sup>3</sup>	13.44 in. <sup>3</sup>
Radius of gyration.....	1.23 in.	2.25 in.

### New Purox Welding Torch and Cutting Attachment

The Linde Air Products Company, 30 East 42nd Street, New York, N. Y., has recently made two new additions to its line of Purox medium pressure apparatus for oxy-acetylene welding and cutting.

The new Purox No. 11 welding torch, which supersedes the Purox No. 10 torch, has a very wide welding range extending

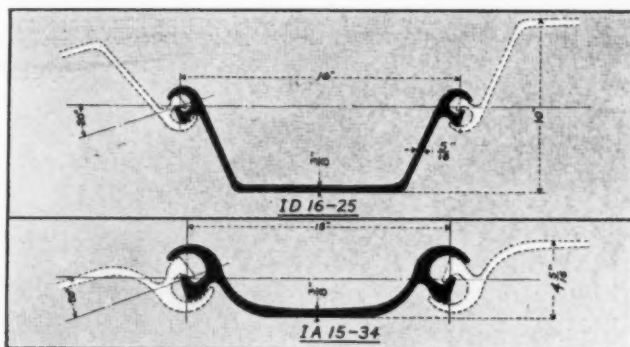
21 cutting attachment with the Purox No. 20 welding torch.

### New International Model A-2 and B-2, 1½-Ton Trucks

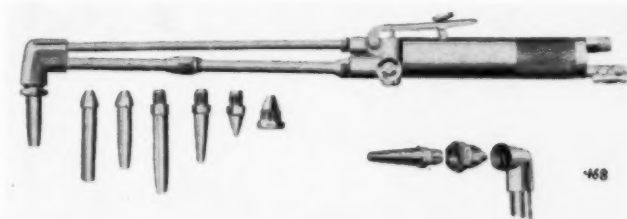
International Harvester has recently announced two new 1½-ton trucks, the Models A-2 and B-2. These Internationals incorporate all the desirable characteristics of preceding Internationals of the same size and type and, in addition, have many performance features that make them superior to their predecessors.

The Model A-2 is built in two wheelbases, 136 and 160 in. Both wheelbases have a body allowance of 1,200 lb. and for commercial hauling and delivery service both have a maximum carrying capacity, including body and pay load, of 4,200 lb. However, for dump truck service a maximum gross carrying capacity of 4,575 lb., body and pay load, is permitted on the 136-in. wheelbase chassis.

The Model B-2, called the Six-Speed Special, is built only in 136-in. wheelbase.



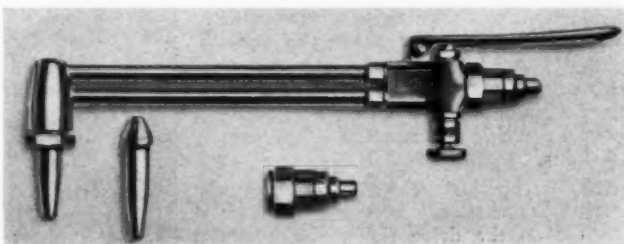
New Inland Steel Sheet Piling



Milburn's New Torch Set

The Milburn RIF-A torch may be immediately converted from a cutting torch into a welding torch by use of an adaptor, No. 630, made under Milburn patent rights. This adaptor is designed to take Milburn standard FX welding tips and tips similar to Milburn Type FX welding tips. These Milburn FX tips will also fit

from the lightest sheet metal up to work as heavy as ½-in. plate. In spite of this wide range the torch is very light in weight and has perfect balance. The tips are of one-piece, hard-drawn copper construction and are so designed that the head angle can be easily adjusted as desired by the user. Tips Nos. 2, 4, 6, 8, and



Purox No. 21 Cutting Attachment

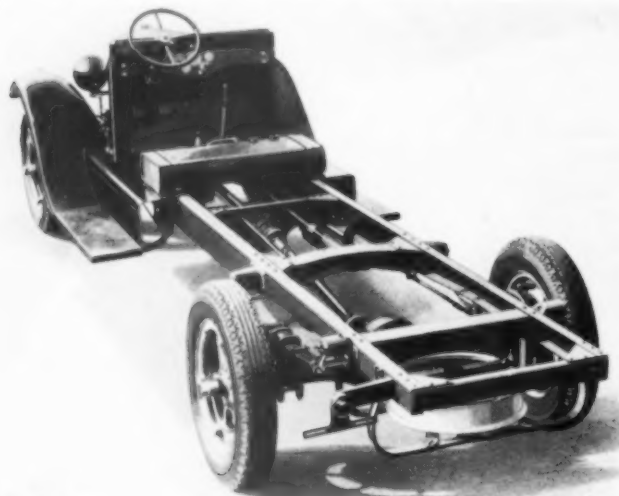
It has a maximum gross carrying capacity, body and pay load, of 4,200 lb. for commercial service and 4,575 lb. for dump truck service.

Both of these trucks employ the same units throughout with the exception of rear axles and transmissions. In the Model A-2 the rear axle is of the single-

speed spiral-bevel drive type. In the Model B-2 a two-speed axle, which, coupled with the three speeds of the transmission, provides six forward and two reverse speeds, is used.

In the Model A-2 a four-speed transmission with one reverse is employed, while the Model B-2 has a three-speed transmission.

Both of these new Internationals are



Two New International

powered by 4-cylinder, L-head type engine, 3 $\frac{3}{4}$ -in. bore by 4 $\frac{1}{4}$ -in. stroke. Piston displacement is 185.8 cu. in. and the engine develops a maximum of 39 brake horsepower at 2,400 rpm. Its maximum torque is 120.5 lb.-ft. at 1,000 rpm.

Pressure feed lubrication to all main, camshaft, connecting rod, and wrist pin bearings is provided by the gear-type, gear-driven oil pump. A balanced-flow type carburetor, efficient manifold, and specially-designed cylinder head (compression ratio 4.6) guarantee maximum engine efficiency and fuel economy.

### Northwestern Manufacturing Co. Announces Arc Welder

The Northwestern Mfg. Co. of Milwaukee, Wis., announces a new Hansen arc welder that is designed for mounting in a truck and which is driven by the same engine that propels the truck.

This unit consists of a special 200 ampere Hansen arc welding generator with a range for metallic arc welding of from 60 to 325 amperes. To this is attached (at option of purchaser) a 1 $\frac{1}{2}$  K.W., 110 volt, D.C. auxiliary generator which furnishes power for operating electrical tools and lights.

Unit is operated through "V" belts driven from a special four-groove pulley mounted on the drive shaft. Belts and pulley are protected from dust and dirt by a special housing. When unit is to be used, a clutch lever mounted in the cab is released. This disengages the rear end of truck, and engages the governor on engine as well as the driving pulley.

Although unit is illustrated on a Ford Model A pickup truck, it can be just as successfully mounted on and used with

any standard make of truck. The operator of this unit has a welder as well as a truck at approximately the same cost as that of a standard gasoline engine driven arc welder.

Provision can be made for carrying oxygen and acetylene cylinders as well as tools that the operator may desire to use. In other words, the welder using this Hansen outfit has a complete welding shop

dumping time; oversize clutches and brakes give effortless and accurate control; hoist clutches are power set; all operating levers toggle in. The double-operating chocking brakes are applied from the operator's stand; a swing brake is provided for operating on a grade; the direction of the operating levers can be easily changed to suit the individual operator.



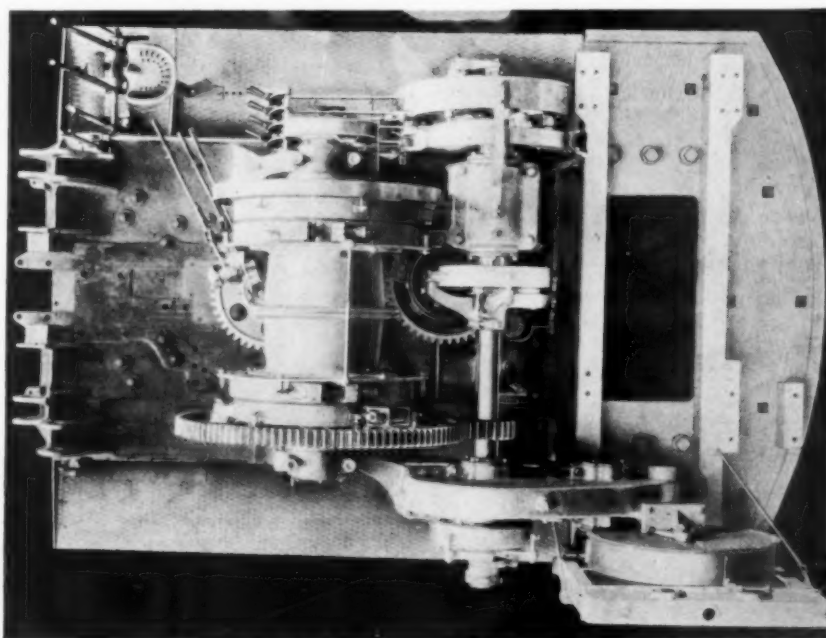
Hansen Arc Welder Announced by Northwestern

on wheels and is prepared at low cost and a moment's notice to do any sort of a welding job, anywhere, at any time.

### Another Bucyrus-Erie Convertible Shovel

Another new machine recently put in production by the Bucyrus-Erie Company, South Milwaukee, Wis., is the 21-B,  $\frac{3}{4}$ -yard gasoline, diesel, or electric, convertible shovel-dragline-crane-clamshell. Many features have been included to make it easier for the operator to turn out maximum yardage every day. A power dipper-trip saves energy and cuts

When moving, the machine is steered from the operator's stand with the cab in any position; the propelling brake is also controlled from the stand, a friction brake locks the swing during propelling. The new Bucyrus-Erie 3-side-vision cab provides the operator clear visibility of all parts of the work from his seat. Ball bearings for all continuously running shafts, and only two bearings to a shaft cut down repair expense. Careful attention has been given to accessibility and convenience in oiling and greasing. Both reversing transmission, for swinging and propelling, and engine transmission are fully enclosed and run in oil.



Bucyrus-Erie  $\frac{3}{4}$ -Yd. Convertible Shovel Upper Deck



# SNOW REMOVAL ~SECTION



THIS SECTION  
CONTINUES IN  
OCTOBER  
AND  
NOVEMBER  
ISSUES  
OF  
ROADS & STREETS



## Decatur County, Iowa, Digs Out



*This page shows a few pictures of snow removal in Decatur County, Iowa.*

*A "60" tractor with "home-made" plow is working in frozen snow which had been moved and had drifted in again and froze.*

*Since the pictures were taken we have built a plow with adjustable wings which works good. We have five of the plows which were made in our shops at a cost of less than \$200.00 each. The hitch is from the drawbar and goes under the tractor.*

*Time limits my story.*

Floyd K. Brown  
County Engineer



By W. J. WELLS

Flathead County Engineer,  
Kalispell, Mont.



*Battling Snow Is Provoking When the Wind Drifts It Where It Has Just Been Cleared*

## Montana

# COUNTY FIGHTS SNOW

## To Rescue Marooned

**F**LATHEAD COUNTY began snow removal in the winter of 1919-20 with a home made wooden V-type plow. We used it with a 5-ton Federal truck for power for the first two years and then mounted it on a 10-ton Holt. It was used until 1927 when the county bought a Caterpillar-60 and a one-way plow. This outfit was very satisfactory, and was run continuously; changing shifts every 12 hours. Each shift averaged about 36 miles. The cost was 96 cents per mile, figuring depreciation.

In January, 1929, we had an exceptionally severe storm that completely blocked our roads, piling up drifts in some places to a depth of 12 feet, and some of them 500 feet through. We were forced to buy a 75-Monarch and a rotary plow. This outfit averaged only about 20 miles per shift, and the average cost per mile of operation for the winter was \$1.56, but we opened our roads and kept them open.

Last year we bought another 75-Monarch and a big V-wing type plow. We had it out only once, but that once was enough to show us that we had made an excellent investment. This gives us three types of plows; the one-way for the mountain side hill, the V-type for the valley, and the rotary when we get to the point where neither of the other two can do the work.

Our snow conditions vary a great deal. Some winters we will spend about \$1000.00, and then again we will go as high as \$20,000.00. A week would have covered all the time we put in on snow removal last winter, while the winter of 1928-29 we fought snow with everything we had for over three months. In fact, while we were battling snow with the rotary in the upper end of the valley the latter part of March we were doing spring maintenance work at the same time in the lower end. When it snows here it is generally a blanket running from 12 to 24 inches in depth, and wet and heavy. If we get a dry snow and the wind blows,

conditions become extremely bad across the north end of the valley.

Just as soon as fall road maintenance is over, we run the Monarchs into the shop and completely overhaul them. Then we mount the one-way and the V-type plows on them, and run the equipment into the shed ready for the first storm of the next season. If the snow gets too deep and we need the rotary, we remove the one way and mount the rotary in place. Just as soon as the storm is over and the wind has died, both plows leave with type-written orders for 24 hours ahead. As each relief leaves the shop they have the same orders with 12 hours additional added to them so that in case they make better time than was first estimated they still have orders under which to run. Each crew, as relieved, reports to me what has been accomplished on their shift as soon as they get in. The only positive orders given them from which they must never deviate are the following:

1. Always leave a road behind you that is clear so your change of shift can get to you with gas and oil.
2. If the wind starts to blow, and the road that you have just plowed is drifting full behind you, start back to the shop over the road you have come.

Emergencies are always arising in snow removal, so the men must be given a free rein and allowed to use their own judgment. This winter we are changing to an eight-hour shift, for once in a while the relief gets delayed in reaching the plow. Formerly the men were out from 15 to 17 hours, which is too long.

Snow removal work is the hardest we have on our equipment. The snow melts and runs down over the track bearings, and freezes them full, stopping lubrication, and the whole tractor itself is generally working to its limit in either low or second gear. After a winter of bucking snow, we have to overhaul the equipment again. One thing that we have found that pays big, is to run into the shop as often as possible and thaw the machinery out. We have built our shop door

## FLATHEAD COUNTY, MONTANA

### Standing Orders

#### *To Snow Fighters:*

1. Always leave a road behind you that is clear so your change of shift can get to you with supplies.
2. If the wind starts to blow and the road back of you is drifting badly, start back over the road you have just opened.

large enough to allow our largest piece of equipment to be driven inside. After we fire up it takes about 10 hours to get rid of the snow and ice. Then we lubricate, and go over everything. All broken parts are replaced or repaired, all loose rivets tightened, and breaks welded. By so doing we get away from road side repairs, to a big extent. There are a lot of things more pleasant than lying in a snow bank making repairs which, if caught in time would have saved a good man from catching a bad cold. How many of you "Bosses" have ever laid in a snow bank, 20 below zero, making a repair with a welding torch? That is what made me build those big doors.

Snow fence is a valuable adjunct if one will study their location, and take into consideration wind velocity. Some fence we place as close as 40 feet from the ditch line, some as far as 200 feet. We are discarding the old board fence as fast as it goes to pieces, and are buying picket fence in 100-foot rolls. It costs us one-half cent per foot to erect, and about one-quarter cent to take down. We buy our fence from a local mill at 6½ cents per foot. Steel posts cost us 46 cents each. We make our own iron stakes out of scrap. We have found that anything less than a 30-inch stake is useless.

During the winter we are almost sure to get emergency calls after a bad storm. Instead of the work on these calls getting to be an old thing with the boys, they fly into it with just as much vim as they did on their first call. Two years ago we dug out 40 men, 50 horses, and 13 cars that were marooned in a logging camp. They had used up their last bit of hay and oats, and were practically on their last meal when the rotary got there. Last winter the only storm we had all winter came the first of November. It was about 2 feet deep in the valley, and better than 6 feet in the mountains. It came so quick that it caught 17 cars up on the Continental Divide with 42 people in them. We started the V-type to them and in 42 hours had dug out the last car, 80 miles from here. The snow was so deep for the last two miles that one couldn't see the cars. They were completely buried. I could go on in-

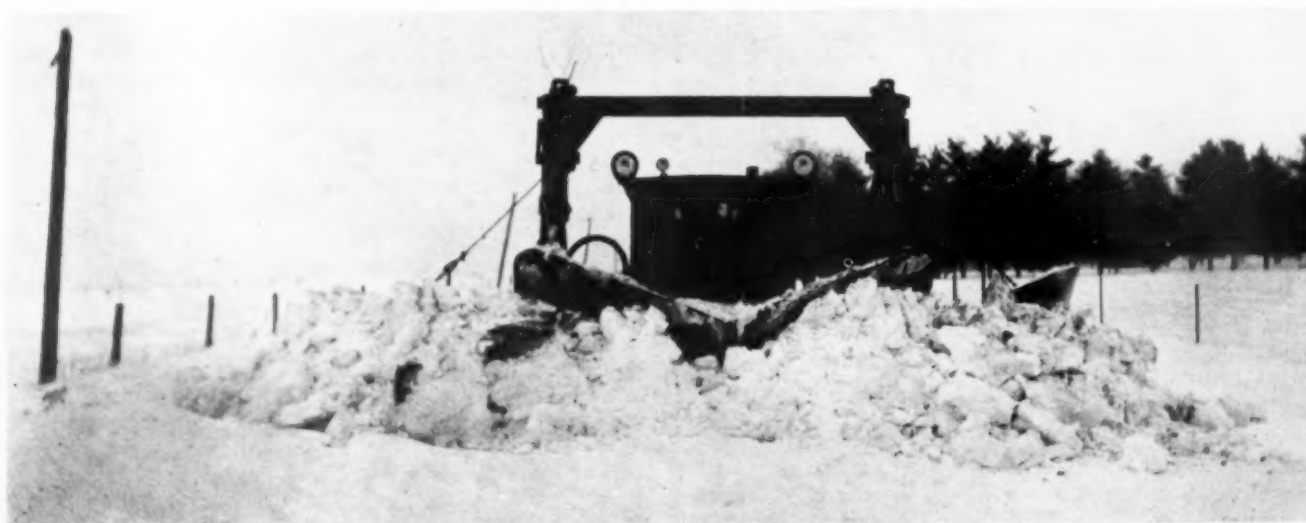


*Here Comes the Rotary!*

definitely telling about digging out some poor soul that had to be rushed to the hospital, or opening a road to let relatives and friends put some one in their last resting place. It wouldn't be of interest, but yet that kind of work has never become common place to us.

Snow removal work is sometimes provoking. So much of the time you have everything clear, and you feel that you have accomplished something, when the wind commences to blow. Then you have the whole thing to do over again. Each time it is just a little harder to get moved.

In Montana we have no levy for snow removal, all the money has to come out of the road fund. If we get a bad winter the next spring the roads have to suffer for it. My opinion is that all states should allow the counties to build up a special snow fund that should be held up to a certain amount, raising or lowering the levy each year to maintain that fund to its maximum amount. With a fund of this type which can be used for snow fighting only, the counties will always be ready to open drifted roads and permit business and travel to proceed as usual.



*We Cleared Snow in the Upper Valley While Doing Spring Maintenance in the Lower End*



# Traveling Men Marooned

By MAURICE RICHARDSON

Chief Patrolman, State Department of Public Works,  
Imperial, Nebraska

THE first storm which we had last fall took place on the 19th of November. It started with a rain that later turned to snow. The following morning the wind blew a perfect gale, drifting the snow in places where snow drifts were unknown in times before. Of course the roads were impassable. Huge drifts filled cuts in the road to their capacity.

Immediately men were started to opening the roads with shovels and at the same time two snow plows were started from Imperial, each going in opposite directions. In two days time the roads were open on United States highway No. 38 from the Colorado line to 50 miles east which was at the end of my district on this highway. On the high line, in Perkins and Hayes counties we were all very busy opening roads where the traffic was tied up. Several of the traveling men who were in the tie-up were very uneasy as they thought staying in one town two nights was a severe crime. Although we were busy all the time with snow plows and men doing all we could at all times to get the traffic moving. These men were disgruntled because they were delayed.

After the storm had blown over we were favored with a couple of months of nice weather which was very much approved by road men. At the end of this time the roads were beginning to look more natural when on the night of March 27, 1931, one of the worst storms of the season struck us. It was very much



*This Car Did Not Get to Elsie, Nebraska, Perkins County, Until the Snow Plow Came Through on Highway No. 17*

more destructive than any storm I had ever witnessed.

Again the roads were full and the only thing we could do was to repeat our efforts. After hiring some single handed men we started the snow plows. Most of the men prayed that this work might continue for several weeks as most of them had been idle most of the winter; but very much to their disappointment the roads were open in good shape in a few days time.

The road men did not do all of the suffering. The stock raisers and farmers were heavy losers, losing cattle and stock of all kinds. Chase County suffered a



*Coming Through a Long Deep Stretch on the Level on March 28, 1931, in Perkins County, Elsie, Nebraska*

loss of about three thousand head of cattle, which was a hard blow in these present pressed times. Perkins County was also hit hard, while in Hayes County the storm wasn't so destructive. The wind was fully as high in Hayes County, but the snow wasn't so heavy.



*Temporary Halt for Inspection of Equipment, November 21, 1930*

We removed the snow off of the roads, as far as possible, to avoid badly cut up roads. At this time of the season roads could have been destroyed very easily. The storm was a hard proposition. It seemed to me that snow was piled as high now in sections as a man could throw. In a few places men were placed in stairstep



*First Time Through a Deep Drift We Take the Upper Half; Then Follow Through to Get the Lower Half*

style because of the depth and in this manner the huge drifts were moved back.

During melting most of the water went in the ground and a good prospect for a good corn crop is at hand in these three counties. Our wheat crop wasn't as good as usual and the price was against the farmer while in some localities the yield was fairly good. But in all the farmers are looking for better times.

## Cold Story for a Hot Day

By D. R. SAVAGE

Cottonwood County Engineer, Minnesota

*This being the time of the year that plans are in preparation for snow removal activities of the coming season, letters were written to some of our readers asking them to cooperate in a mutual exchange of ideas and experiences on snow removal and winter maintenance. Below is a letter from Windom, Minnesota.—Editor.*

### COTTONWOOD COUNTY HIGHWAY DEPARTMENT

OFFICE OF D. R. SAVAGE  
Dist. Engineer

WINDOM, MINNESOTA, July 10, 1931.

Editor of ROADS AND STREETS:

It has been terribly hot, but your request for a snow removal story has moderated the weather so that living is possible. Quite a stretch from the 104 in the shade of the last week to what I am to write about when a stalled motor on a broken snow plow cannot be started until another truck hauls it into a machine shed. Twenty and thirty below does not tend to start a gas engine promptly; especially after a breakdown has held the machine in the open for twenty-four hours at those low temperatures.

Cottonwood County, Minnesota, is in the southwest part of the state, about 150 miles from the Twin Cities and a little less from Sioux City, Iowa. Hence it has no milk routes into the cities and it is not imperative that our roads be kept open to preserve life, as no bottle babies are depending on our dairy products for their nourishment. What have babies to do with snow removal? Well, closer to the cities milk routes from the dairy to the city MUST be kept open or little ones will starve. The population have become so accustomed to prompt delivery of milk, etc., that a delay of several hours means disaster.

With us it is not so imperative. Besides, it costs a lot to keep roads clear. At the risk of being dubbed a "stick-in-the-mud" or worse I will say at the outset that *I do not believe in snow removal in our section.* I believe in snow prevention as far as possible; that is, mowing weeds at the roadside, snow-sloping cuts, and using miles and miles of snow fence. But when money is spent for snow removal it is kissed good-bye forever



*Traveling Right Along in a Light Snow, Four Feet Deep*

and after the next storm you can kiss more money good-bye and the higher the sides of the cut get the faster you can work your kisser. Farmers can get to town with a "pung" if they have no sleigh, the same as they did in pioneer days. The "peddlers" can ride on the train and let the joy riders stay at home and learn that there is such a place.

However, the demand is for "the open road" so we can use that new car or old car, else what is the use of keeping up the payments. The car must go if we have one; and who hasn't? Hence, our county board decided to buy a snow plow three years ago. We bought it over the telephone, in January. It came. We worked it *hard*. Our roads were opened and kept that way. Great success apparently resulted. No one, except the county engineer who saw the costs and knew something of the strains to which the crawler tractors were put, thought differently.

The next winter there was deeper snow. On 175 miles of road allotted to us our one outfit was swamped. It worked well, but the task was too great, so we bought a second outfit. We opened the roads and the next year was ready for anything, for we had repaired the outfit, strengthened the weak places, and renewed what was necessary. Let her "bliz"—we're ready. But it didn't snow at all. Our husky snow removers were sent out just once, and the snow melted before we got back. We had three Sundays in last February when a picnic lunch could be enjoyed out in the country. And we were ready for snow. Well, we are still ready. Those repairs are still good.

The public is our employer, and the public demands winter roads, so it behooves public officials to become



*Breaking Out a Cross Road*

posted upon the respective merits of different machines and systems of snow removal. So far, I think we have made no mistakes, since it has been decided that we must keep the roads open by snow removal.

The first machine one should get for this section of the country is, I believe, a V-plow with wings for a crawler tractor not smaller than a "60." For light snow fall and shallow drifts such a machine is too slow and the second machine should be a truck plow with one wing, if not two. The truck plow can run out over the road system in a short time and can wiggle through quite a sizable drift, leaving a hole that will do for a time until the larger plow can clean up and widen out the track. We generally try to get the maintenance man or patrolman to follow the plow with his small grader and clean up the "crumbs" or small chunks of snow which are too small for the large plow to turn around for.

It is amazing to see how long a well cleaned cut will last in stormy weather. A deep cut often seems to have a draft through it that tends to carry the snow cut of it. Another small point to remember when using

animals. (A man who has to stand outside on a snow plow all night soon gets to feel that he is an animal and will soon act like one.)

Both of our plows came to us with outside control, but we changed them to inside control after one season. To handle a snow plow requires considerable dexterity. One man driving the truck or tractor and one plowing makes a team. Among a bunch of men it is necessary to pick out teammates—as you would in matching up horses. We run night and day until our roads are cleared; two shifts a day.

Regular hours are hardly possible, although we try to change the shifts at regular times. A car carries the new crew out and the tired one in, delivering oil from our central storehouse at the same time. We get gasoline at the small towns through which we go and we carry a double capacity tank supply.

Our rate of pay has been 50 cents per hour. The men eat and sleep where they find themselves. Some carry a lunch from home.

They work on the county grading crew in the summer, and in the shop for short periods in the winter.



*Rear View, First Time Through a Deep Cut of Light Snow. Note Shelter Built to Protect Plow Operator While the Plow Control Was Outside of the Cab*

a plow with wings is the widening that the wings will do. Four feet above the track the wings can push the snow beyond the shoulder. This shelf will often hold all the snow that drifts in during a light blizzard. This was first called to my attention by a patrolman who asked us to use the wings in this manner when possible. He said, "that shelf will hold all the snow a little blizzard has."

Several makes of plows are carried on the truck or tractor that pushes them and are carried clear of the ground when not plowing. This is very necessary, as shoes wear out very fast and the tendency is to neglect them. When this happens the mould-board goes at the lower corners. We have found it necessary to make shoes out of special steel. They cost us from 30 to 35 cents a pound. No matter how heavy the plow shoes are turned out from the factory we have always had to make them heavier. Wings lifted by hand are out-of-date. Some kind of an hydraulic hoist is necessary. To lift a wing over a mail box by hand would take so long that it would not be done and either the mail box is destroyed or the wings are lifted up and left there. The hoists must be controlled from the inside of the cab, too. A man working on the outside winding on a hoist or handling a valve gets too cold to keep an interest in his work; besides, it is cruelty to



*Last Trip Through a Deep Cut*

They are thus available for snow plowing when they are needed. Of course, there is not always work for them, but in this section winter work is not always to be found and experienced tractor and machine men are willing to take more menial positions in the winter so as to be on the job when the skilled labor is needed.

We do some work for the townships or for private parties when our state aid and county aid roads are cleared. We have figured that \$6.00 per hour was about the cost of the outfit; operators, gas, oil, repairs and depreciation, a man and car to act as tender, and about half the time of one man in the office keeping track of conditions by telephone. Nearly all of our breakdowns have been on township roads. Township officials do not think of snow plowing during the summer it seems, for in grading the roads they leave a ridge in the middle, deep dips, narrow cuts, and possible stones set at the ends of culverts. We try to eliminate all of these on our roads where we expect to plow the snow.

In ordinary snow banks where a tractor can get through without bucking we could always count fifty miles ahead in twenty-four hours. A tractor would travel four miles an hour in high. This gives ample time to turn around in drifts and widen out the cuts. But when the drifts get so deep that bucking is neces-



sary or it is necessary to lift up the plow and take off the top part of the drift for a short distance then back up and take out the bottom, you cannot count on any definite distance in a day. A truck plow sent out after a light snow will cover the ground and be back again in surprising time. A hundred mile trip in a day and night is nothing. But a truck has to hit the banks hard



*A Hard Packed Drift Before the Plow Strikes It. This Snow Was Hard Enough to Bear Up a Team. It was Dirt Covered, Thawed Some, and Then Frozen*

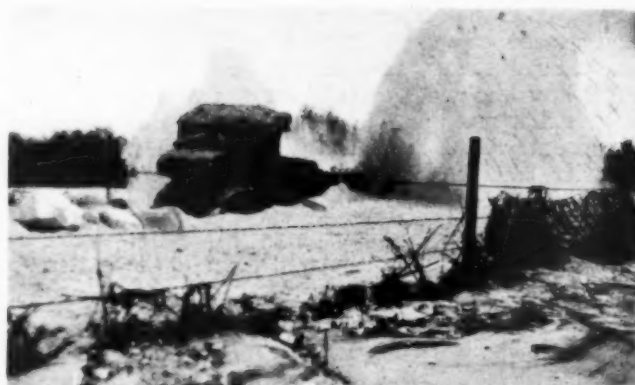
to do its best work, and often it is turned end for end in less than fifty feet, which is about as dangerous to life and truck as it is spectacular. To be able to get the machines out when we want them we have wired our sheds so that electric heaters can be applied to the engine blocks, thus warming them up while a storm is in progress. When the storm stops there will be no delay in getting the motors running.

We have found the companies selling tractors, trucks and snow plows very efficient in the service they have



*Nose of Plow Raised for Turning Around at the End of a Cut*

given us in supplying repairs after breakdowns. Service is what makes the mare go in the machinery game. Following is one instance: During a change of crews a drip cock on a tractor came loose and the new crew lost the oil from the tractor after five hours' running. At 5:00 a. m. two wrist pin bearings had burned out on a tractor twenty miles from our base. Long dis-



*A Combined V and Rotary Plow at Work in the Neighboring County, Murray County*

tance telephone caught the tractor company's office when no one but the janitor was there in the morning. The repairs were put on a train 150 miles away at 8:00 a. m., taken off the train at 3:00 p. m., hustled out the twenty miles by auto and replaced in the tractor so that it was going again by 8:00 p. m.; a delay of only fifteen hours, for what was apparently a serious breakdown. Without Service with a big S by every one from the telephone operator to the janitor we might have been delayed days instead of hours.

*D. R. Savage.*

County Engineer, Cottonwood County.

## Trees for Snow Breaks

In the spring of 1928 the Chicago, Burlington & Quincy R. R. in co-operation with the extension service of the Nebraska College of Agriculture and individual farmers, inaugurated a tree-planting program along the Burlington right-of-way in western Nebraska. The purpose of this planting program is to grow permanent wind breaks to drift snow instead of erecting snow fence each year. American elm, Chinese elm, honey locust, box elder, caragana, Russian mulberry, Russian olive, green ash, red cedar, Scotch pine, jack pine, Austrian pine, western yellow pine and limber pine are the varieties of trees and hedge growths planted for this experimental work. Some of the stock survived wonderfully while others were a complete failure.

One, two, or three rows were planted, depending upon the type of mature plant. If snow fence protection can be secured economically by this method, state and county highway engineers would do well to use this same method of protection. The experiment could well be watched by highway engineers.

The Florida Citizens' Finance and Taxation Committee recently submitted to the governor and the legislature recommendations suggesting the installation of a uniform system of accounting and reporting for all counties, the payment of county officials by salary instead of by fees, the consolidation of counties where possible (about half of the 67 counties have less than 10,000 population each) and the abolition of sub-districts in all counties with a view to making the county the smallest unit of government.

# County Snow Crews Win Public Good Will and Cooperation

By WM. H. BEHRENS

County Engineer, Linn County, Iowa

THE UNUSUALLY heavy snow in Iowa, early in 1929, brought the problem of snow removal very forcibly to the attention of the road officials of Linn County, which is ordinarily in the lighter snow belt. At that time there were 135 miles of roads directly under the supervision of the Board of Supervisors and the county engineer. Two seasons previous a V-type plow with hydraulic controls had been purchased for a "60" tractor. The season it was purchased there was only one snowfall which warranted its use; the next season the snow was light and was removed with motor patrols. We had commenced justifying the expenditure for the machine on the grounds that it was an insurance against snow when the aforementioned storm of 1929 hit us. We were easily convinced that Linn County was "road minded," at least as regards use of the roads and a demand for an all-year road; if not in the matter of providing the funds. Township officials, associations, groups, and individuals appealed to the Board of Supervisors for aid to relieve actual suffering in a storm which was seriously taxing the capacity of even the primary system. At the same time the state legislature seemed inclined to pass the Bergman law which would place all roads not in the primary system under the jurisdiction of the Board of Supervisors of the respective counties. This would mean an additional 1000 miles in Linn County and we frequently asked each other what we would do about snow removal in advent this law was passed. To relieve the situation immediately at hand the county purchased another plow of the same type and proceeded to clear the county roads. Then the surfaced roads of the townships, roads to schools, cemeteries and the municipal air port of the city of Cedar Rapids were cleared on an hourly rental basis. Needless to say two snow plows did not effectively remove the snow on a road system of some 1200 miles in extent. However this was an unusual situation and the county's demonstration that they were equipped and able to care for the portion for which they were then responsible, i. e., 135 miles, invited and made available the good will and cooperation of the public when this equipment was directed to relief in quarters where our responsibility did not extend.

The Bergman law was passed in 1929 and on January 1st, 1930 the Board of Supervisors and county engineer assumed the responsibility for the construction and maintenance of a road system of 1200 miles. Fortunately the snow was light that year and seven motor patrol units made a showing in keeping the roads passable. Fortunately, also, the previous year of storms had built up a spirit of cooperation and toleration which is unexpected by men long in the public employ. Offers to remove snow if furnished tools were received and met by placing small blade graders and V-drags, acquired from the township's equipment that had been turned over to the county, at their disposal. Thus the day was saved for 1930 during a time when reorganization was taxing us to the limit.

Developments throughout the year 1930 showed that

the public who in the main were in accord with the principles of the Bergman law would expect a more efficient and effective system of snow removal than of the previous two years.

The following equipment was at our disposal for the 1931 snow season: Sixteen push type motor patrols, four equipped with V-plows and snow moldboards; four truck plows; and two tractor plows. With this equipment, excepting the two tractor plows, it was possible to clear the entire system in three and one-half days of the light snows of 1931. A very heavy snow late in the season presented a problem as yet unencountered. The frost had already left the surface of the ground,



Aerial Views of Cedar Rapids Airport Showing the Cleared Runways After the Snow Had Been Removed by a "Caterpillar" Sixty and LaPlant-Choate Hydraulic Operated V-Plow

the drifts were of such depth requiring the tractor plows for efficiency, and they could not be used on anything but surfaced roads because of the lack of traction. Warm weather proved our best ally in this situation.

Snow fence is used to some extent in Linn County, 36,000 ft. being used in 1931. It is our practice to adequately fence sections of road rather than attempt to get the worst spots on the entire system.

Our conclusions and policies about snow removal are as follows:

(1) Linn County normally in the light snow belt is subject to heavy snows and drifts and at a time when



ground conditions are most unfavorable for snow removal. This condition must be kept in mind when purchases of maintenance machinery are made.

(2) Light snows must be cleared from the entire crown of the road as soon as possible on the entire system.

To facilitate this grade lines must be laid as high above normal ground level as possible on new construction; the right of way cleared of trees, brush, and weeds on ungraded roads; the constructed roads brought to true cross-section; and projecting objects such as culvert headwalls suitably marked in the early winter so that high speed equipment can be used.

(3) A conservative policy regarding snow fence has been adopted.

## Snow Removal Practice in City of Allentown, Pa.

By E. W. MECKLEY  
City Engineer

THE maintenance of traffic during and after a snow storm over the streets of our city is accomplished by the co-operation of the city highway department and the Lehigh Valley Transit Company.

Statistics show that we may expect one or two heavy snow falls in one year, averaging about eight inches in depth. Our policy is to start with plowing and removal operations as soon as a depth of three or four inches of snow has fallen.

The equipment used in this work consists of truck plows, trolley plows and brooms, and tractor snow plows for the plowing operations. Motor trucks, Barber-Greene loader and gasoline shovels are used for the snow removal operations.

The Lehigh Valley Transit Company operates car plows and brooms as soon as a few inches of snow have fallen. On certain streets in the city they must remove the snow from curb to curb on account of franchise requirements. However, as soon as the snow is at the proper depth, they supplement their car equipment with motor truck plows and push the snow to the curb. As the snow accumulates from the plowing operation and from cleaning the sidewalks the transit company starts their Barber-Greene snow loader to work. The city furnishes the motor trucks for the removal operation on streets that have no franchise requirements and the transit company performs the entire operation where their franchise requires them to do so.

On the streets that have no car tracks, the highway department performs the work in a similar manner as described above. The loading of snow is accomplished by hand labor, gasoline shovel equipped with an oversize bucket, or the Barber-Greene loader of the transit company is rented on an hourly basis depending on the quantity and extent of the work.

Some difficulty has been experienced in securing a convenient and accessible place to dispose of the snow after it is loaded on trucks. This problem has been solved by dumping from nearby bridges into the stream beneath, and is accomplished by removing a section of the bridge railing or dumping over the railing, and in the case of new bridges a special snow hole opening in the form of a casting with a removable top has been installed in the roadway of the bridge.

We have been unable to keep exact unit costs on this work that can be considered reliable. The cost per season to the city averaged over a period of five years has been approximately five thousand dollars, which covers the cost of snow removal only where necessary on about five miles of streets and on the remainder (about fifty miles) only plowing methods are used.

With the small equipment at our disposal we have been able to keep the main streets of our city open during the winter weather with very little inconvenience to the traveling public. Our local press has often commended the results we have attained in keeping the streets and highways open after a snow storm. We look forward to a snow fall as just so much necessary work and are always confident that we can make a successful fight against the weather man, and render the motoring public a real service.

## Frost-Boil Work Near Morris, Minn.



*The Full-Revolving Shovel, Having Dug Itself in, Moves the Dirt in Front Directly to the Rear, the Work Covering the Extent of the Frost-Boil Area*

## On the Treeless Plains



*A Typical Section of Oklahoma Graded Earth Road, Complete and Under State Maintenance*

There is a working agreement between the American Association of State Highway Officials and the American Road Builders' Association by which equipment problems are studied jointly.





McCormick-Deering Tractors provide reliable power for any snow-removal program, and for other road work the year around.



Breaking a drifted road with a McCormick-Deering-powered snow plow.



Streets are cleaned fast with this McCormick-Deering-powered snow loader and an International Speed Truck.



Above: Excavating shovel mounted on a McCormick-Deering Tractor and used for removing snow. Below: A snow plow mounted on an International Heavy-Duty dump truck.



McCormick-Deering Model 30 Industrial Tractor, 40 h. p. engine. Model 20 is similar in design and has a 25 h. p. engine.

## Remove the Fear of Being Snow-Bound

**W**INTER loses its grip when plans for snow-removal are laid well in advance, and crews and equipment are ready for action. *Transportation* has to move freely the year around in these times to get the full benefit of the tremendous investment in roads and automobiles. *Mail* has to get through, *business* has to be kept going, and *life* and *property* must be protected. All of these depend on the open road.

Your snow-removal program hinges on power that can stand the gaff in this heavy work. McCormick-Deering Power has made a record as a top-notch snow-fighter and today it is the accepted standard throughout the snowbelt. In the form of Industrial Tractors and as the power heart for a variety of snow-removal equipment, it provides plenty of driving force to break through drifts and keep roads and streets wide open.

McCormick-Deering Power is built to stand the shocks and strains of bucking the drifts 24 hours a day, for days at a time. Because of its economical operation it makes the budget for snow-removal go further.

Convenient service backs up McCormick-Deering Power wherever it is at work. There are 117 Company-owned branches in the United States and Canada, more than 50 McCormick-Deering distributors, and thousands of dealers ready to give factory-standard service at all times. They will be glad to demonstrate for you. Write us for information.

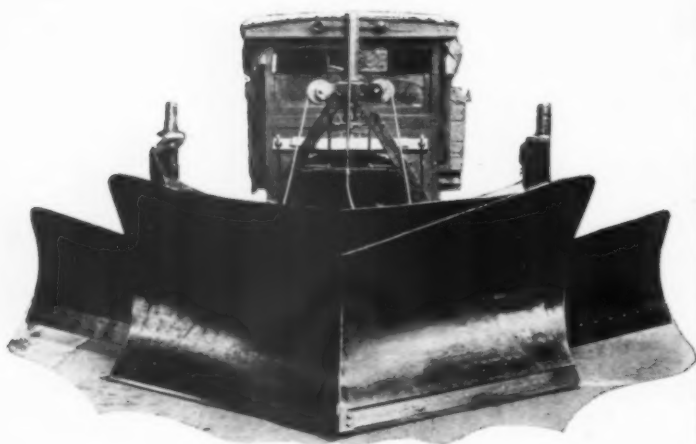
INTERNATIONAL HARVESTER COMPANY

606 So. Michigan Ave.

OF AMERICA  
(Incorporated)

Chicago, Illinois

# MCCORMICK-DEERING INDUSTRIAL POWER



## A "Sensation" Root's Big Buster

Traffic keeps on the move when Root V-type Snow Plows are put to work. Easy to handle, dependable, standing up to the hardest sort of punishment, they give a lifetime of trouble-free service.

Root's "Big Buster"—a heavy-duty plow especially designed for large trucks—has unusual strength and durability and, when needed, can be used with two powerful trucks, working in tandem.

Equipped with hydraulically operated extension side wings, the Big Buster plows to full width, banking the snow as it passes and preventing any drifting back under the truck. These wings can be quickly extended to full length, held in any intermediate position, or folded back against the truck by a simple application of hydraulic pressure without stopping the truck or requiring the operator to leave his seat.

The Big Buster is fast, economical and dependable—with a performance record that is truly sensational.

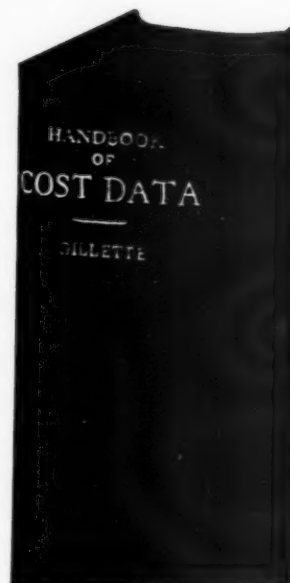
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**ROOT SPRING  
SCRAPER CO.**  
**Kalamazoo, Mich.**

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is  
HANDY  
PRACTICAL  
HELPFUL

*and*



**Worth Its Weight in Gold  
When Kept at Hand  
for Constant Reference**

A handy book from which you can take profit each time you consult it,—that describes H. P. Gillette's "Handbook of Cost Data." If in its 1854 pages there is not more value to you than its price, you do not need it. But we believe you will find it worth many times its cost. Thus, we offer to send it for your examination, so that you may either buy or return it. Read our offer in the coupon below, then fill in and mail it.

### Some of the Subjects Covered

Principles of Engineering Economics and Cost Keeping—Earth Excavation—Rock Excavation, Quarrying and Crushing—Roads, Pavements and Walks—Stone Masonry—Concrete and Reinforced Concrete Construction—Water Works—Sewers—Timber Work—Buildings—Railways—Bridges and Culverts—Steel and Iron Construction—Engineering and Surveys—Miscellaneous Cost Data.

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COST DATA**

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400 W. Madison St., Chicago, Ill.

Please send me postpaid for free examination the "Handbook of Cost Data." In ten days I agree to return the book or remit \$6 in full payment and keep the book for my further profitable use.

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# *unobstructed* **VISION**



**IS  
ABSOLUTELY  
ESSENTIAL  
IN A  
ROTARY  
SNOW  
REMOVER**

**S N O G O**

SNOGO is the only rotary that gives the operator full vision at all times.

• • • • •

Not only throws the snow to either side with the wind—but throws it from the **WINDWARD SIDE** OF THE MACHINE.

• • • • •

The snow stream never crosses the operator's line of vision.

SEND FOR THE COMPLETE SNOGO CATALOG

**KLAUER MFG. CO. DUBUQUE, IOWA**

Do you mention **ROADS AND STREETS** when writing? Please do.





## Choose Snow Plows With a Record For Good Service

*An old user of Baker Plows writes:*

"I have worked with Baker Snow Plows since 1914 and like them better than any other design I have ever used."



For over twenty years Baker Snow Plows have been moving snow in thirty-nine states. The big line of truck and tractor plows now offered are in every way up to the high standard set in the past.

You can't go wrong in choosing Baker "V" and blade plows for light or heavy trucks or tractors. Trip-blade — hydraulic — hand lift — speed type plows are included in the list of dependable plows offered this year.

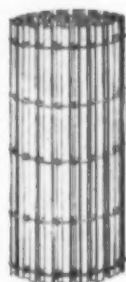
*In sending for catalog, please give names and models of your trucks or tractors*

The BAKER MANUFACTURING CO.

506 Stanford Ave., Springfield, Ill.



## ROWE Can't-Drift

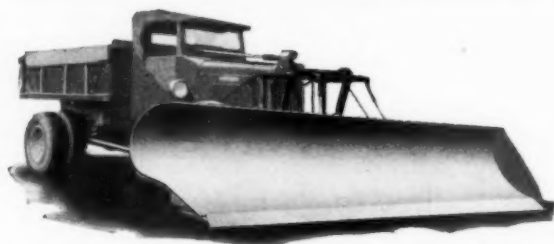


# SNOW FENCE

is being used in every state where Snow Fence is required. Thoroughly tested. Meets every requirement in actual field use.

Made only of No. 1 Pickets and a special galvanized snow fence wire. Pickets tightly woven between wire cables and fence thoroughly stretched in weaving. Won't stretch and sag when put up. Pickets painted with durable red mineral preservative paint—applied HOT. Stock available for immediate shipment from factory or warehouse nearest you. Write our Galesburg Factory for Folder and Prices.

ROWE MANUFACTURING CO.  
700 Liberty St. Galesburg, Ill.



## Clears any road Fits any truck

Heavy snowfall does not penalize the community where Ross Moldboard Snow Plows are in use. Strong — durable — powerful — they have a performance record of more snow under various conditions with less power, due to its properly shaped moldboard whereby it is rolling a live load rather than shoving a dead one. Side draft is eliminated as the pressure is properly balanced with the truck. No top heavy rims nor shoulders left to roll back into the cleaned path as the snow is thrown clear and spread off the shoulders.

Let us send you our latest illustrated literature. Write us today.

THE BURCH CORPORATION  
CRESTLINE, OHIO



# Snow Removal DOES PAY!

**C**ONSIDER the loss when our great network of highways are paralyzed with snow! School costs go on even though children cannot get to their schools! The farmer loses when he cannot get his products to town to catch favorable markets! The customer must have an open road to get to the store to purchase merchandise! Medical attention must be kept within reach of those who need it! Fire hazards increase with the lack of snow removal!

It is economy to every citizen to have good snow removal equipment to protect them against blockaded roads.

The LaPlant-Choate Manufacturing Company has a complete line of snow removal equipment from the largest size tractor plow to the smallest sidewalk plow.

Those who are wise are looking forward to their needs to keep the "OPEN ROAD" during the coming winter.

WRITE FOR OUR LATEST CATALOG.

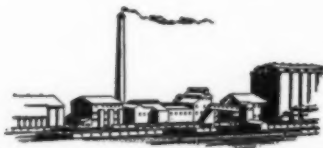
**LA PLANT-CHDATE**  
**MANUFACTURING CO. INC.**  
CEDAR RAPIDS, IOWA. U. S. A.

# Distributor News

## Cleveland Tractor Company Gets Large Order from Penn. State Highway Department

One of the largest single tractor orders ever placed at one time by any state was received recently by the Cleveland Tractor Co., Cleveland, O., from the Pennsylvania State Highway Department. The order called for 125 Cletrac crawler tractors. A second order also from the Pennsylvania State Highway Department called for 28 more Cletrac Cletrac "80-60's."

As a direct result approximately 500 men have been returned to work by



able and semi-portable compressors and other tools, will enable Worthington to supply all air equipment requirements of contractors, railroads, utilities and industrial users.

Worthington's Feather Valve compressors always have been an integral part of Metalweld portable units. It is a natural step, therefore, for Worthington to ac-



*First Trainload of Tractors Leaving Factory for Pennsylvania*

the Cletrac company, not to mention the many jobs that will be created in other companies who supply materials and special equipment to Cletrac.

This is but one instance of what Governor Pinchot's "good roads" program will do to help unemployment both in Pennsylvania and other states. More than \$100,000,000 has been appropriated, out of which a few millions will be spent for new highway equipment alone. The balance is to be used in building 20,000 miles of new roads and for the improvement of 11,000 miles of present highways.

This great road program has been launched under the slogan of "Get the farmers out of the mud," and it is expected to be completed within two years.

## Worthington Acquires Metalweld

It was announced recently that the Worthington Pump and Machinery Corporation had acquired the manufacturing and marketing facilities of Metalweld, Inc., Philadelphia, Pa., builders of a complete line of portable compressor units. For many years Worthington has been a leader in the compressor industry. Last year it took over the manufacture and sale of Gilman rock drills and accessories. This together with the added line of port-

quire the manufacture of the complete product. The portable compressors will be manufactured at the Harrison, N. J., Works of the Worthington Pump and Machinery Corporation, and the engineering, manufacturing and sales personnel of the Metalweld organization also will be located there.

## Bleecker Made Manager of Sales for Lukenweld, Inc.

John S. Bleecker, who has been appointed Manager of Sales of Lukenweld, Inc. (Division of Lukens Steel Company), Coatesville, Pa., was graduated from the Massachusetts Institute of Technology in 1898 where he specialized in both Mechanical and Electrical Engineering. He began his career with the American Bell Telephone Company. Most of his activities for the next twenty-seven years from 1901 to 1928 were confined to executive management of many enterprises for Stone and Webster, Day and Zimmermann and Bates, Inc. From 1928 and until his association with Lukenweld, Inc., in 1931, he was a registered professional engineer engaged in industrial and public utility work, specializing particularly in transportation and merchandising.

## Solvay—Fiftieth Anniversary

September marks the Fiftieth Anniversary of the incorporation of the Solvay Process Company, and with it the establishment of the alkali industry on this continent.

The original thirty ton per day soda ash plant at Syracuse, New York, was the beginning of the tremendous industry which now supplies the world-wide market with alkalies in varied forms.

Rowland Hazard was the founder and first President of the Solvay Process Company. It was he who guided it to the acquisition of the American patent rights of Ernest and Alfred Solvay, perfectors of the method of manufacturing soda ash, now known the world over as the Solvay Process.

Pioneer in the American field, the company has been in continuous operation and is the largest manufacturer of commercial alkali in this country, with plants located at Syracuse, New York, Detroit, Michigan and Hutchinson, Kansas.

In addition to commercial alkalies the company now manufactures an extensive line of related products, including Cleansing Sodas, Calcium Chloride and Liquid Chlorine.

The Solvay Process Company completed the form of organization under which it operates today with the formation, in 1927, of the Solvay Sales Corporation, which has entire control of the sale of Solvay products.

## Westinghouse Appoints James Assistant to Commercial Vice President

William F. James, formerly Middle Atlantic District Manager of the Westinghouse Electric and Manufacturing Company, has been appointed assistant to the Commercial Vice President of the Atlantic Division of that company.

Mr. James entered the employ of the Westinghouse Electric and Manufacturing Company in 1909, becoming engaged in industrial sales work in the Philadelphia office. In 1912 he began to specialize in steel mill electrification, and in 1923 became sales manager of the industrial division. In 1925, he was appointed Middle Atlantic District Manager with headquarters in Philadelphia.

Mr. James is a past president of the Electrical Association of Philadelphia, past president of the Engineers Club of Philadelphia, a member of the Industrial Relations Committee of the Philadelphia Chamber of Commerce; and a member and past regional vice president of the American Institute of Electrical Engineers.



## Colprovia Comes to Ohio

The Ohio Colprovia Co., with offices located at 406 Marion Building, Cleveland, O., has recently acquired the license to manufacture and distribute Colprovia for the entire State of Ohio, and has awarded a contract for the erection of its first plant to the J. D. Farasey Mfg. Co.



*Colprovia Asphaltic Concrete, Fine Aggregate Type, on Perkins St., Akron, O.*

Ohio Colprovia's first plant will be located at the Wagner Quarry Co.'s Soldier's Home Quarry No. 1, at Sandusky, O., and will have a capacity of approximately 750 tons daily, shipping the product in open cars to any point in Ohio.

The Colprovia process is a completely cold process for manufacturing, shipping, and laying an asphaltic pavement, which is manufactured in five different types; such as—sheet asphalt; binder course; asphaltic concrete, fine aggregate type; asphaltic concrete, coarse aggregate type; and asphalt concrete base, commonly called black base.

Colprovia is a product which contains no volatile materials, liquefying agents, or cut-backs, and is not an emulsion. The Colprovia process was first applied commercially in England and is being used in a number of principal countries in Continental Europe. Its first application in the United States was in 1927, when it was put in several prominent locations throughout the East. However, Colprovia is now being used extensively in practically every state East of the Mississippi river, and throughout the entire dominion of Canada.

## Bethlehem Acquires Kalman

E. G. Grace, President, announces the acquisition of the properties and business of Kalman Steel Company, fabricators and distributors of reinforcing steel, concrete accessories for buildings and roads, wire fabric, steel joists, steel door frames and metal lath. This business will be conducted by Kalman Steel Corporation, a Bethlehem subsidiary, which will have the following general officers with head offices at Bethlehem, Pennsylvania:

Paul Mackall, President; George E. Routh, Jr., Vice President in Charge of Sales; Quincy Bent, Vice President in Charge of Operations; R. E. McMath, Vice President and Secretary; Robert Young, Treasurer; F. A. Shick, Comptroller; Charles R. Holton, Purchasing Agent.

Virtually the entire selling organization

of the former company is retained, under the direction of Mr. Routh. Mr. A. P. Clark continues with the company as General Manager of Sales.

All the district sales offices are continued at their present addresses at the present time, but where economy and efficiency can be obtained through combining with the office space of other Bethlehem subsidiaries these will be put into effect. Such adjustments are now under consideration and revised list of the location of district offices will be issued about the first of October.

## \$500.00 in Prizes for Missing Links

In every plant, no matter how well mechanized, there are points where material piles up, unnecessary labor used, machine operations interrupted, where better transportation is needed.

Now is the time to hunt out these missing links.

The Chain Belt Company is offering \$500 in prizes to those that hunt them out.

For the best descriptive article and rough sketch showing how Chain and Belt Conveying or other Chain Belt Company products, including construction machinery, can be applied to lower costs this company offers the following prizes:

1st Prize, \$200; 2nd Prize, \$100; 3rd Prize, \$50; 15 Prizes, \$10.

No obligation is involved. Articles will be judged on merit. No proposed installation is too small or too large, only that it be in an existing plant.

During 1931 the Chain Belt Company found that its costs could be reduced through the application of modern ma-

chinery, by more than the reduction in cost of materials. This contest is instituted to bring out similar situations in other plants.

### Contest Rules

(1) The Chain Belt Company will pay \$500 in cash prizes to persons who send in the best articles and sketches for the use of chain and belt conveying or other Chain Belt products in existing plants.

(2) Articles must be on possible new installations or replacements of existing installations and must contain definite data on possible cost reductions, and be accompanied by rough sketch.

(3) The prizes are as follows: 1st Prize, \$200; 2nd Prize, \$100; 3rd Prize, \$50; 15 Prizes, \$10; eighteen prizes totaling \$500.

(4) The offer is open to everyone except employees or distributors of the Chain Belt Company or their families. There is no obligation.

(5) All entries must be received at the offices of the Chain Belt Company, 1600 West Bruce Street, Milwaukee, Wisconsin before 5 P. M. on September 21.

(6) Contestants may submit as many sets of articles and sketches as they wish, provided they cover different proposed installations.

(7) All entries should show name, address, position, and firm. Names of contestants or companies will not be published without authorization.

(8) The judges will be appointed by the Chain Belt Company. Their decision will be final. In case of ties, duplicate awards will be made tying contestants.

## Gardner-Denver Appoints New Representative

The Hall-Perry Machinery Company of Butte, Montana, has recently been appointed as agent for Gardner-Denver Rock Drills and Portable Compressors. The appointment was effective immediately and the Hall-Perry Machinery Company is now actively representing the Gardner-Denver Company.

The Hall-Perry Company is well known throughout Montana and their appointment has met with considerable interest. This arrangement makes available to Butte and the surrounding territory a convenient and dependable source of service and supply for Gardner-Denver products.

## Announcement

The Headley Emulsified Products Company, Franklin Trust Building, Philadelphia, Pa., announce the appointment of J. G. Campazzie as vice-president, directing sales. Edgar S. Ross is President.

The O. K. Clutch and Machinery Company of Columbia, Pa., recently received an order from the State of Pennsylvania for 32 portable air compressors to be distributed all over the state. Eleven machines were sold to this state about 18 months ago.

## Service Exchange for Manufacturers or Distributors

**Editor's Note.**—From time to time we receive letters from distributors wishing to be put in touch with manufacturers of certain lines of equipment, or from manufacturers seeking representatives of their products. Items of this kind will be published and names and addresses furnished interested persons upon request.

### New Lines Wanted

Distributor covering northern Illinois and southern Wisconsin desires additional lines, especially compressors, form graders and proportioning scales for mixers.

University man, now selling foundry and sheet metal field in Northwest, desires additional accounts on commission basis only. Will travel to factory at own expense and spend necessary time to familiarize himself with line.

Newly organized distributing company located in Boston, desires to secure a few road machinery accounts for New England territory.

Distributing organization located in Tennessee desires to handle a complete line of road building equipment.

Manufacturers' representative, clientele, state of New Jersey. Can represent manufacturers or contractors machinery, accessories, materials for general contractors and stone crushers. Large or small units.

Man experienced in building construction field desires position with construction or engineering firm. Familiar with credit and estimating—also has had some selling experience. Permanent position is desired and location is immaterial.

Civil Engineer, located in California, desires to represent manufacturers of equipment and supplies. Is widely acquainted in western states and can furnish engineering and financial references.

Services of experienced engineer available. Formerly connected with state highway department, and well known manufacturers. Will consider proposition from manufacturer or distributor of highway construction equipment.

Warehouse facilities for serving Pittsburgh territory. Would like to secure line of portable and stationary conveyors.

Distributor covering Wisconsin and Illinois territory wishes to add to present lines. Thoroughly familiar with bituminous materials and equipment for handling.

Distributor situated in Portland, Oregon, desires line of stationary diesel engines, from 75 to 150 hp., to serve western trade for driving rock crushers and industrial plants.

Manufacturer's representative with 25 years' sales experience, conversant with all types of pumps and their field, desires agency for either New York or export territory or both.

Sales engineer, experienced in earth-moving machinery, desires connection on salary or salary and commission basis. Wide acquaintance with machinery dealers, oil and gas industry, pipe-line contractors and material men. References.

Manufacturer's representative situated in New York City, now handling pumping machinery, would like to take on two or three additional lines serving the same field as his present account.

Distributor situated in Virginia wishes to make connection to represent manufacturer of manganese crushing plates and jaw rock crushers.

Wanted, line of picks, sledges and crow bars, spades, shovels and similar implements by New Jersey broker, with warehouse facilities, contacting New York and New Jersey jobbers.

Distributor of building specialties covering territory within 100 mile radius from Chicago is equipped to represent additional lines.

### Representatives Wanted

Textile manufacturer wishes sales representative to handle complete line of tarpaulins. Distributors, now handling road building equipment and other contractors' supplies, especially desired.

Manufacturer of crushing and screening plants wants a representative in Manila, Philippine Islands.

Manufacturer of grader wants dealers in west and east central states.

Manufacturer of a new tractor dump wagon has a number of desirable territories open. Full cooperation extended to distributors.

Manufacturers of ditching and trenching machines, to facilitate the laying of pipe lines has liberal proposition to offer dealers.

Manufacturer of metal traffic lane markers for pavements, has a number of desirable territories open. Write for their proposition.

Manufacturer of air compressors and contractors' tools has number of desirable territories open. Full cooperation will be extended to distributors.

Manufacturer of complete line street repair equipment, tar kettles, heaters, patching plants, torches, etc., has open territory in southeastern states and desires active distribution. Territory largely open from Virginia to gulf states, inclusive, also state of Oklahoma.

Eastern manufacturer of grade-rippers, scrapers and road hoes has desirable territory open for distributors.

Long established and well-known manufacturer of industrial locomotives wishes to make contacts with qualified distributors. Locomotive line includes steam, gasoline, gas-electric and oil-electric. Supported by national trade journal advertising.

Distributor with large warehouse, show room and service facilities, desires two or three additional lines. Maintains large sales organization, covering New York, Vermont, Maine, Massachusetts and Connecticut.

Manufacturer of asphalt ingredient adaptable for use in the road or industrial field, is seeking representatives for desirable territory in various parts of the country.

California territory available for distributor wishing paving expansion joint account.

Manufacturer of transverse testing machines desires to build up distribution organization in this country and abroad.

Several desirable states open. Wanted, distributing organizations covering entire states by manufacturer of mechanical spreader.

Territory open in several states for representatives to handle grade-rippers, mechanical plows.

Manufacturer of steel dump bodies and oil heaters seeking distribution points in west central and southern states, including Missouri, Kansas, Iowa, Nebraska, Colorado, Kentucky, Tennessee, Mississippi, Arkansas, Louisiana and western half of Illinois.

Attractive territory open in states south and west of Chicago by manufacturer of cut-to-length, easily-erected standardized steel highway bridges, for spans up to and including 40 ft. Product sells to highway commissioners and superintendents.

Manufacturer of metal tie and spacer wishes to establish distributing points throughout the country.

Manufacturer of contractors and builders levels and transits is seeking district sales manager. Exclusive contract given. Excellent territory still available. Backed by national advertising.

Manufacturer of complete line of construction equipment, mixers, saw rigs, plaster and mortar mixers and pumps has an open territory in the state of Maine and is looking for an aggressive distributor to represent him there.

Manufacturer of patented luminous highway danger signs and signals is interested in securing aggressive representation in various parts of this country and Canada.

One of the leading manufacturers of surveying instruments in the United States is seeking responsible agents in all sections of the country. Instruments are nationally advertised in all leading engineering journals.

Manufacturer of patented highway and zone marking machine desires sales representatives who are acquainted with highway officials in their own state.